ELECTRICAL REVIEW

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IN THIS ISSUE

Chemical Engineering	711
Lighting Sports Arenas	713
Netherlands Electrical System	719
Engine Starter Motors. By W. Subak, Dipl. Ing., A.M.I.E.E.	721
New Books	724
Views on the News	725
Personal and Social	726
Institution Centre Chairmen	729
I.E.E. Meetings	732
Luton Airport Control Tower	733
Electrical Geography	734
Commercial Motor Show	737
Commerce and Industry	739
Recent Introductions	743
Engineering in Europe	745
Electricity Supply	747
Fractional H.P. Motors	749
Fluorescent Mine Lighting	753
Financial Section	754
Next Week's Events	758
New Patents	759
Contract Information	761
Classified Advertisements	123
Index to Advertisers	138

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ELECTRICAL REVIEW 3rd OCTOBER, 1952

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. CLI • NO. 3906

Chemical Engineering

THE achievements of, and trends in, chemistry received attention at the recent British Association meeting in Belfast, where consideration was also given to the training of the chemical engineer and his function in industry. Sir Harold Hartley opened the discussion on the subject, perhaps because earlier this year in his valedictory address as retiring president of the Institution of Chemical Engineers he had talked about chemical engineering being at the cross-roads.

Chemical engineers have attained to professional status only during the last fifty years; there is now a shortage of them in most industrial countries. The number of first degrees granted in chemical engineering in the year 1949–50 in America was 4,529. The 15,000 trained there during the five years ended September last are believed to have had an important bearing on the rapid progress of industry in the United States. The annual output of chemical engineers from all sources in this country between 1950 and 1954 is estimated at 200. Comparison of these figures will speak for itself; meanwhile chemical engineers are infiltrating into all sorts of industries and their strategic science seems likely soon to make them key figures in a society that is becoming more and more dependent on the careful control of a multitude of chemical reactions. Energy—meaning power and heat—is the pivot on which continuance of our present form of civilization depends. Power station efficiency and steam boiler availability involve chemical engineering: combustion, radiation, heat exchange, boiler deposits, water treatment, cooling towers and corrosion are all, because of temperature and pressure elevation, more urgently in need of the chemical engineer's attention. As Sir Harold has pointed out, the chemical engineer is not to be regarded as a newcomer in competition with the older branches of engineering, but as complementary to them in intimate partnership. The contribution which chemistry is making to the development of atomic energy is not always as fully appreciated as it might be.

The economic future of this form of energy will depend upon the close collaboration of scientists and engineers in which, as Professor W. Wadlow remarked at Belfast, the role of the chemist will probably be a vital one. Even if chemistry has sometimes, as in the case of foodstuffs, seemed to give with one hand and take away with the other, it would be unwise not to take the fullest advantage of the co-operative assistance which might be rendered in many engineering respects by what has been called the fourth primary technology, which is dependent in a variety of ways on the older three.

NEXT YEAR'S FAIR

There was a general impression of a falling-off of enthusiasm at the British Industries Fair last May. Manufacturers were no doubt harassed by material shortages and by a feeling of uncertainty regarding rearmament orders and their possible effect upon normal production. Nevertheless it was still agreed that the Fair had become an essential feature of our industrial life and must be continued. Next year is Coronation year and there will be a general revivification which should extend to the B.I.F. The celebrations will attract many more visitors to this country and although the Fair takes place a month before the Coronation it may be hoped that many of them will take in both events. The Board of Trade is now taking active steps to create interest in the Fair among potential overseas buyers.

PRODUCTION AND WAGES

The claim by employees in the engineering industry for an increase in pay was referred to by Sir Harry Railing at last week's meeting of the General Electric Co., Ltd. He emphasized that unless we got full output per man and machine we could not meet the costs of our competitors. Customers overseas would not pay us for workers who were less efficient, worked shorter hours or demanded a higher standard of living, however desirable, than those of other suppliers. The engineering unions contended that the pay increase, which on the original basis of £2 a week would amount to £250 million a year, should be provided "out of profits." Sir Harry pointed out that as two-thirds of the profits went in taxation, that amount would have to be met by other taxation. There would also have to be a cut in capital expenditure on new tools, etc., or a rise in prices which would give a "further twist to the spiral of inflation."

EUROPEAN INTERCONNECTION

The primary aim of the study undertaken by the Electric Power Section of the Economic Commission of Europe is to provide material relating to interconnection possibilities. The reports, reviewed in this issue, support the view that the realistic approach is by way of an evolutionary expansion of a system, the rough framework of which already exists, so as to make the fullest economic use of the several kinds of power resources which are to be found in Europe and of the diversity of consumers' demands.

I.E.E. BENEVOLENCE

It is disappointing to learn of the drop in the amount subscribed to the I.E.E. Benevolent Fund during the past twelve months despite the increase of Institution membership. The consequence is that the income has failed to cover the expenditure, which is unlikely to decrease as time goes on. The Governors in their report, reviewed on a later page, point out that if the remaining two-thirds of I.E.E. members not now contributing to the Fund would send only 5s each per annum, this would increase the revenue by £6,000. A further help could be given if more agreements were made to guarantee payments for a period of seven years, as this would make them free of income tax.

Lighting Sports Arenas

Methods Employed and Results Obtained

By W. S. VENESS*

WHEN planning the artificial lighting of sports arenas, certain basic points have to be considered but each stadium has its particular problems. Among the biggest sports users of artificial light are dog tracks (Fig. 1, p. 714) and speedway arenas. Football by artificial light has been played on the Continent and in America extensively for many years, but only in the last season did it gain popularity in this country.

In the main stadiums where a varied programme takes place continuously, much of it under artificial light, the illuminating engineer is constantly in demand. His is the task of trying to find a broad basis of lighting suitable for all purposes so that the minimum of special lighting has to be installed for each event.

Huge crowds are involved in night-time sporting events and before consideration is given to lighting the actual attraction, adequate light must be provided for the crowds to move about safely (see Fig. 2) without risk of pocket picking or physical injury. In the event of accidents or disturbances, police and attendants must be able to operate easily and quickly.

Up to the end of 1945 the lighting of the spectator stands had been generally carried out with industrial type fittings, laid out on factory lines. But, owing to the varying angles, this method resulted in considerable glare and illuminating engineers were called in to deal with this problem. The early illumination in the stand (Fig. 5) was

* Lamp and Lighting Department, Metropolitan-Vickers Electrical Co., Ltd.

Above: **The 1951 Greyhound Derby at the White City Stadium. The band and King's Squad of the Royal Marines. Lighting from steel towers**

FT-CANDLE MEASUREMENTS OF ALL TRACKS TAKEN 12" ABOVE GROUND LEVEL

Track	Lamps	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Poles	kW
	Watts	Centre of lamp to hare rail		Height to fitting		Distance between poles		Track Width		Ft-c under standards						Ft-c between standards							
										12" from hare rail		Under lamp		36" from outside fence		12" from hare rail		Under lamp		36" from outside fence			
		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B		
White City, London	1000	9′	10′	10′ 6″	10′ 6″	17′	14′ 6″	23′ 6″	24′	14	10	27	23	14	13	12	10	22	22	14	11	97	98½
Harringay	1500	16′	13′ 6″	16′	16′	29′ 6″	29′ 6″	26′	22′	13	10	19	20	9	11	8	9	21	22	13	10	45	67½
Stamford Bridge	1000	10′ 6″	9′ 6″	11′ 6″	13′	20′	19′	20′	20′	17	14	28	23	11	14	17	10	25	24	9	16	70	70
New Cross After mods. from 1950	1500	4′	4′	16′	16′	18′	18′	22′	19′	25	28	36	36	24	25	30	30	32	34	22	25	60	90
Hall Green, Birmingham After mods. from 1950	1500	—	13′	14′	13′ 10″	31′	24′ 6″	33′	27′	—	12	—	24	—	6	—	8	—	12	—	5	45	67½
White City, Manchester	1500	7′ 9″	7′ 9″	14′	15′	13′	13′ 6″	21′	19′ 6″	20	22	25	25	14	12	22	22	23	25	15	13	70	105
Belle Vue, Manchester After mods. from 1950	1500	4′	4′	16′	16′	22′	22′	24′	21′ 6″	22	26	20	26	6	22	20	20	14	18	7	8	60	90
Powderhall, Edinburgh	1000 1500*	12′	12′	13′ 9″	13′ 9″	35′	20′ 29′ 6″	29′	24′ 24′	6	10 6	13	16 14	4	8 8	6	8 6	12	12 10	3	7 7	52	52

A Bend. **B** Straight. * No information regarding ft-candles.

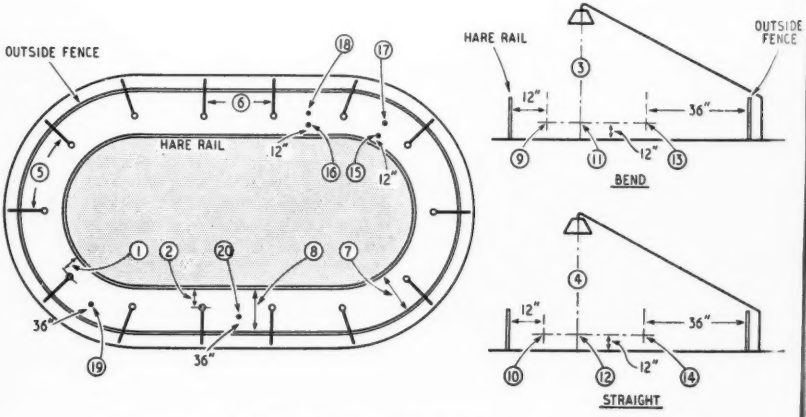


Fig. 1—Ft-candle measurements of light on greyhound tracks belonging to the Greyhound Racing Association

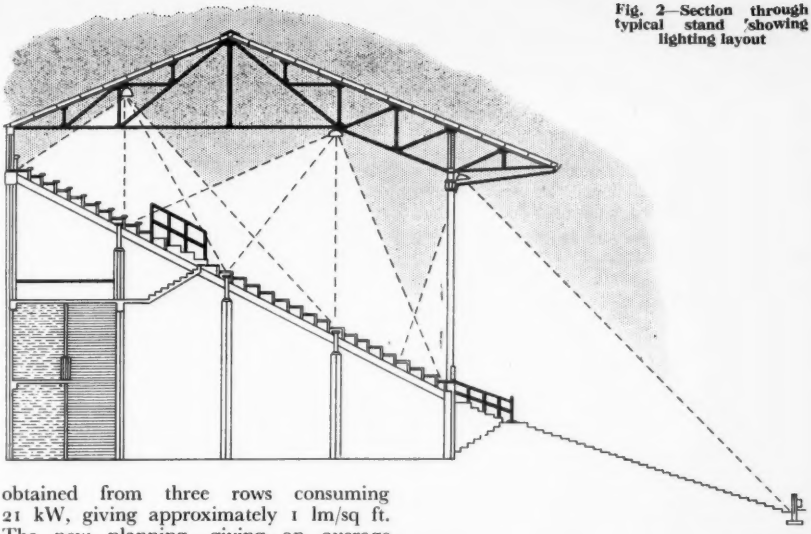


Fig. 2—Section through typical stand showing lighting layout

obtained from three rows consuming 21 kW, giving approximately 1 lm/sq ft. The new planning, giving an average reading of 3 lm/sq ft, was accomplished by the use of two rows of high-bay enclosed-type heavy duty lanterns (Fig. 3) with a total loading of 30 kW. The terraces were originally lighted by large specially made floodlights using 2 kW tungsten lamps. Being in an advanced stage of deterioration, they were replaced by 22 open type 1 kW exterior floods (Fig. 4).

This floodlight consists of two reflectors: the main one of heavy gauge pressed steel, finished with vitreous enamel, green outside, is of shovel shape directing the light forward and downwards; the auxiliary reflector of anodized aluminium is mounted inside the main reflector behind the lamp so as to increase the distance of light throw. The reflectors are attached to a die-cast canopy of aluminium alloy, which

Fig. 3—High-bay unit

Fig. 4—Exterior floodlight, open type

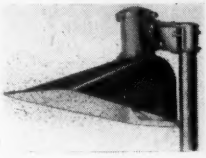


Fig. 5—Stand lighting, Wembley Stadium

houses the lampholder and is carried on a cast bracket of either pole-clamp or pole-top pattern.

The effect of this combination can be seen in Fig. 5. The whole arrangement is free from glare and affords ample illumination for reading the very close print of the programme generally used. An interesting point in this installation is the use of raising and lowering gear for the high-bay enclosed type of unit. Two units are lowered on each winch, one in the back row and one in the intermediate row. This considerably reduces maintenance costs. A reference to the graph (Fig. 6) on the open type floodlighting lantern will be of interest; this principle is now being followed at most tracks in the country. Comparison of the original loading with the later scheme is as follows:—

Industrial reflectors	21 kW
Specially made reflectors	60 kW
Heavy duty type reflectors	38 kW
Open type exterior floodlights	30 kW

With the reduction of 13 kW a greater illumination was obtained with much less glare and considerably less maintenance cost, showing the value of correct planning with the right type of unit.

In the circulating areas and around the totalizator booths, street lighting practice is adopted, giving greatly increased illumination with less maintenance. The refractor type of lantern is employed with a heavy gauge sheet copper hood, the bowl having symmetrical distribution, using 500 W and 300 W tungsten lamps according to the slope of the terracing.

The main problems to be considered for lighting the track are the variations in speed between the different types of sport and the colour background on which they take place. The speed of dogs running on grass tracks is 32 to 35 miles an hour, while the speed of motor cycles on a black or red track averages 42 m.p.h. to a top speed of 45 m.p.h. with, of course, lower speeds at bends and higher on the straight.

In the past, general industrial type units have been used for lighting the track, but in a number of cases they have been replaced by a vitreous enamelled reflector with a rectangular opening measuring 18in by 15½in and 18in overall (Fig. 7).

The lamp is offset from the centre of the rectangle towards one of the long sides which is more nearly perpendicular than the opposite long side. The two short sides and the long side nearer to the lamp are all lined with etched anodized aluminium panels for projecting light along and across the track. The reflector is attached to cast aluminium alloy flanges by three set bolts. Flanges can be either side or top entry, the side entry flange having pinch bolt fixing on to 1in gas barrel and the top entry being tapped 1in gas. A skirted porcelain G.E.S. lampholder is provided and there are alternative bosses in the flange for mounting it so as to enable either 1,000 or 1,500 W lamps to be

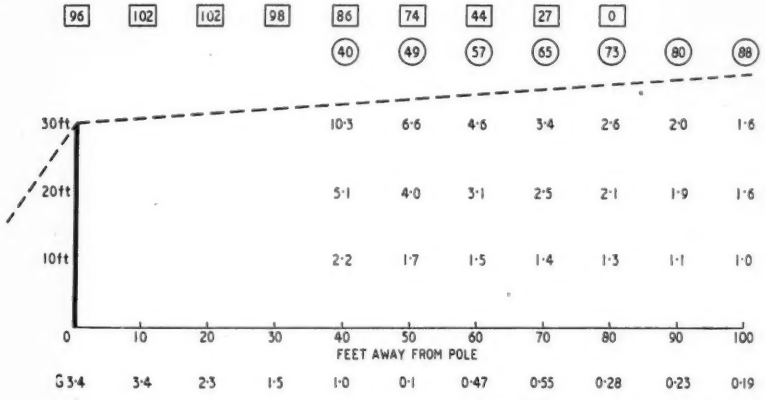


Fig. 6—Light distribution of open type floodlight

correctly placed; when using the 1,000 W lamps the holder is mounted on the long bosses and with 1,500 W lamps on the short bosses.

This unit will illuminate both a greyhound course and a speedway in the same stadium. It will illuminate both tracks by the simple mechanical rearrangement of the posts, saving the laborious method of taking down and re-erecting both posts and lighting for the various types of meetings.

It is preferable for fittings to be mounted on poles situated between the tracks so that they can be swung round to illuminate either the greyhound course or the speedway track according to the requirements of the meeting, thus avoiding a duplicate installation of fittings or an unnecessary number of poles.

For speedways the arm of the pole should project so that the fitting is about 9ft inside the track; it should be mounted so that the central reflector on the steeper side projects the light inwards across the track. For greyhound racing the fitting centre should be only 3ft from the inner side of the track. For both types of track the spacing of the fittings should be at intervals of the order of 20ft along the track, with the light centre 14ft above ground. When used as described above for twin tracks, 1,500 W lamps are recommended so as to cater for the wider track used for the speedway.

Tests have been taking place with a fitting using the mixed light of tungsten and mercury discharge lamps in one unit. The colour correction method has been installed at one track in a modified form for this season's speedway. On this particular track there had already been installed two industrial type reflectors with 2 kW tungsten lamps; because of shortage of time and for reasons of economy, a standard exterior type industrial reflector with a 500 W mercury discharge lamp has been fitted between the two 2 kW tungsten units. Undoubtedly the temporary method will be replaced later by a number of units, each carrying both a tungsten and a mercury discharge lamp.

Occasionally there are staged displays and tournaments, which entail the use of long range floodlighting. The arena illustrated on p. 713 is 648ft long by 348ft wide and is illuminated from steel towers 135ft high, spaced at four positions around the arena, each carrying thirty-six 1 kW units. This type of installation is, in the opinion of a number of illuminating engineers, the best for night football.

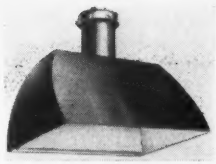


Fig. 7—Special track unit

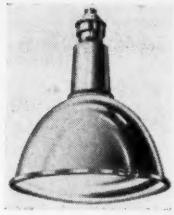


Fig. 8 (*right*)—High-bay unit for boxing and ice hockey

The primary requirements for football are reasonably uniform illumination on the playing area with a diversity not exceeding about three or four to one, a vertical illumination effective up to a height of 35 to 40ft and—what is the most difficult factor—freedom from glare both for the spectators and the players.

It is not considered possible to design a complete scheme which could be used in any football arena. A number of installations have been carried out, but they are experimental, generally for practice games. In fact many enthusiastic amateur clubs have installed a few open type units (such as Fig. 4) for this purpose.

The diversity in the layout of both grounds and stands requires some such system as that installed at one stadium where four steel towers are spaced around the ground as previously mentioned. A refinement would be the addition of spill shields to cut off glare. It is only by such a method that uniformity can be obtained. Unfortunately, owing to the general economic situation such schemes as this must be held up for some time.

No doubt the next few years will show a marked increase in evening football. For it to be successful, good schemes must be installed; cheap inefficient installations will have a bad effect on the standard of play and will not be supported for long by the public.

Other sports for which the lighting has been re-planned are boxing and ice hockey. In each case high-bay units have been employed (Fig. 8), designed so as to require as little maintenance as possible. A heavy-duty top is fitted with a clear glass visor cover rendering it dustproof, and therefore much less liable to deterioration of light output than open type fittings. The

reflector is made of aluminium with anodized finish, providing a semi-specular reflecting surface to direct the light in a concentrating type of distribution and at the same time avoid striation.

For boxing the ring has to be erected overnight; the canopy and its lighting equipment must be light in weight with the minimum number of units, the latter because the cabling has to be run from a distance. These considerations make it impossible to use discharge lighting because of the weight of the control gear. The angle of vision and the control of illumination over the ropes are determined by the mounting height of the canopy and the side shields thereof. The canopy is generally equipped with twenty-five high-bay units, each containing a 1 kW tungsten lamp.

For ice hockey, however, a mixture of tungsten and mercury discharge is used. Four banks each of 15 high-bay units are mounted at 45ft from the level of the ice; thirty-six of them contain tungsten and twenty-four mercury discharge lamps. A similar arrangement is used for table tennis.

For cycle "Marathons" a section of mixed lighting is used, such as twenty-four 400 W mercury discharge and twenty 1,500 W tungsten. In addition thirty 1,000 W high-bay units are mounted round the track, which is 178 yd in circumference.

This brief review of lighting for sports has mentioned only the main branches whereas the services of illuminating engineers are being called upon in connection with a great variety of sporting field events.

Details of the White City and Wembley Stadiums are published by kind permission of the chief engineers of these Stadiums.

Ministry of Labour's Services

THERE are a number of points of electrical and allied interest in the annual report of the Ministry of Labour and National Service for 1951 (H.M. Stationery Office, 6s net).

The section of industry in which the greatest proportion of operatives worked overtime was engineering and electrical goods (34·3 per cent). In the "metals, engineering and vehicles" group there were increases of 66,000 (to 3,332,000) in the number of men employed and 52,000 (to 878,000) in the number of women.

The Ministry was able to meet most demands for engineering workers for the production of power station equipment for the British Electricity Authority; 3,582 vacancies were filled but 1,488 were outstanding at 19th December, 1951. At the end of the year over 14,000 building workers were employed in power station construction and extension. Owing mainly to completion of contracts the number engaged on construction for the North of Scotland Hydro-Electric Board declined during the year from about 4,000 to 3,641.

Employment in the electrical wiring and contracting industry continued at a high level although the average number of workers in 1951 was about 68,000 as compared with 70,000 in 1950. There was little unemployment in the industry, the average rate of 1·05 per cent being about half that for the previous year.

The series of special inquiries into the present and future demand for and supply of persons with professional qualifications in science and engineering was completed during the year, with the publication of a report on metallurgy. At the request of the Advisory Council on Scientific Policy a further review of the position in certain branches of science and engineering was undertaken.

In a chapter on "Negotiation, Conciliation and Allied Work," reference is made to the establishment by the B.E.A. of the National Joint Managerial and Higher Executive Grades Committee covering officers with salaries rising to over £1,500 per annum who are outside the scope of the industry's National Joint Board and Council.

Arbitration activities during the year included the setting up of a Court of Inquiry into the dispute between the Electrical Trades Union and the London Electricity Board and the examination by a Committee of Investigation of the dispute between electricians and employers at the Festival of Britain site. During 1951 a referee was appointed to deal with an individual claim for compensation under the Electricity (Supply) Acts, 1919-31 which was successful.

Netherlands Electrical System

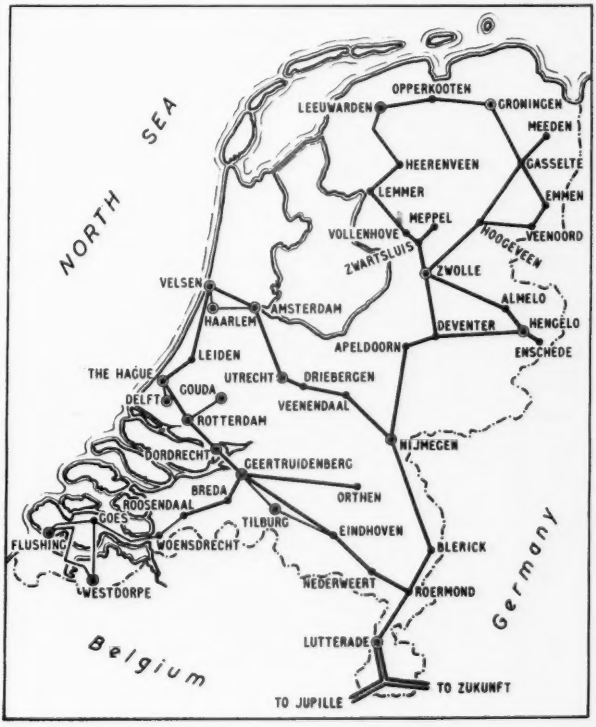
National Grid Now Being Commissioned

IN connection with the visit of the International Electrotechnical Commission to the Netherlands, reported in our last issue, *Electrotechniek*, the official organ of electrical undertakings in that country, issued a special number dealing with electrical developments there. A leading feature is an article on the co-ordination of public electricity supply production.

Water power resources are said to be negligible and generation is based on coal, some oil being used in present circumstances. Condensing water can be drawn from rivers or canals, cooling towers being exceptional. There are now 20 power stations owned by ten provinces and large municipalities. Five new stations at Amsterdam, Dordrecht, Nijmegen, Zwolle and Roermond are under construction, the last-named by a company which has hitherto purchased electricity for distribution from colliery stations in Limberg province. The 400 MW Hemweg station (Amsterdam) will have indoor storage for 50,000 tons of coal to avoid loss of 1 to 2 per cent of fine coal by the wind.

For steam turbines a standard of 50 MW is usually adopted for both new and extensions to existing stations with either one or two boilers per set, the unit system generally being favoured. In 1951 nearly 6,000 million kWh was generated for a maximum demand of about 1,350 MW which was limited by some restriction of consumption during peak hours. Only once has load-shedding by disconnection of consumers been necessary, as energy at peaks can be imported from Belgium and Germany via two 190 MVA links and a 150/220 kV 100 MW transformer at Lutterade.

By 1953–54 enough new plant should be available to meet demands without imports. In 1939 about 570 million kWh was generated for a demand of 720 MW;



Map showing the new national grid of the Netherlands

during the war years the output fluctuated and declined considerably. These figures include imports and exports of electricity and omit industrial generation (mostly for coal mines and subsidiary chemical plants) which has gradually decreased to 1,690 million kWh in 1951.

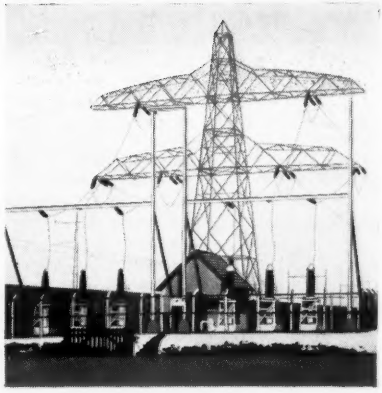
Interconnection between the 10 kV cable networks of the provinces was formerly at voltages up to 60 kV, giving transmission capacities of 20 to 25 MW, but before the war a few 150 kV and 110 kV lines were built as the nucleus of a national grid, which is now going into commission and is calculated to save 550 MW of reserve plant when the total m.d. reaches 2,000 MW. For this purpose the ten undertakings, while maintaining independence, set up a company (S.E.P.) to be operated under conditions stated in the article.

The 150 kV system comprises 360 miles of overhead double-circuit 150 sq mm overhead lines, rated at 2×100 MVA, and 35 route miles of oil-filled cable. The 110 kV system, for the less densely populated north-east, consists of 250 miles of double-circuit 95 sq mm overhead lines, rated at 2×50 MVA, and 1·6 miles of cable. The impulse insulation level at 150 kV is from 750 to 800 kV and at 110 V it is 550 kV. All towers are earthed and two or three 50 sq mm bronze earth wires have been installed. The neutral of both systems is earthed through arc-extinguishing coils. Impedance relays have been adopted for fault protection with a total operating time below 0·1 sec for the first zone, which includes the total length of a line. Total break-time of circuit breakers is similar, giving 0·2 sec overall. System operation is controlled from a national centre at Arnhem.

Electrified Railways

In another article, on the Netherlands railways, it is stated that about 400 million kWh is supplied annually to 800 miles of double-track electric railways, out of a total of 2,000 miles for all kinds of traction, resulting in a saving of 350,000 tons of coal. The equipment of 354 miles originally electrified was destroyed during the war, but the same system, d.c. at 1,500 V, was adopted for the reconstructed service which was completed in 1948.

The electrified system deals with 65 per cent of passenger-train miles and 34 per cent of goods-train miles, the latter mostly at night. Substations are spaced at an average distance of 12½ miles; they are now equipped with remotely controlled 1,200 kW pumpless rectifiers. By next January there will be 240 multiple-unit trains made up of two- to five-car units. Including sets on order, locomotives number 95, ranging from 2,800 to 4,300 h.p., all suitable for both freight and passenger duties.



Change-over from overhead line to underground cable in 150 kV system

I.E.E. Benevolent Fund

THE annual report of the Court of Governors of the Incorporated Benevolent Fund of the Institution of Electrical Engineers shows that the capital at 30th June last had appreciated by £2,717 to £129,071, of which £15,214 was in respect of the "Chesters" Trust (Homes Fund). Income declined by £2,055 to £15,873, including £2,352 received for the "Chesters" Trust, of which £2,000 was from a single deed of covenant. There were 12,862 subscriptions and donations to the General Fund, which brought in £11,245, compared with £13,057 for the previous year. Expenditure notably increased and exceeded income from subscriptions by £2,511. Grants aggregating £9,058 were made to 121 beneficiaries in assisting whom the Fund also gave support to 96 of their dependants.

Subscribers also executed 1,550 deeds of covenant guaranteeing payments for seven years; this substantially increased the value of their donations as the Fund was thereby entitled to recover income tax. Similar deeds of covenant (260) have been signed in relation to the Homes Fund, which from its inception has received £30,653 in subscriptions and donations. Grants of £104 were made from the Wilde Fund and £130 from the Lord Hirst Fund during the year.

Engine Starter Motors

Some Views on Multi-Pole Designs

By W. SUBAK, Dipl. Ing., A.M.I.E.E.

HEAVY-duty starter motors for petrol and oil driven vehicles in this and most other European countries are usually of four-pole design. In this article, the author suggests that a six-pole design gives an improved performance.

Comparatively little literature is available on the design of heavy duty starter motors, whereas there is no shortage of data on the design of ordinary d.c. motors. As the starter motor is basically a series wound d.c. machine various basic relations may be established.

Two major differences confront the designer of such motors, as compared with ordinary d.c. machines. First, as the starter motor only runs for a few seconds, the temperature rise can be neglected. For this reason, their overall dimensions are much smaller than those of d.c. machines as used for ordinary industrial and domestic applications. In the example we will consider the starting current is nearly 1,000 A; at running speed the current consumed is about 500 A. The armature conductor may be $\frac{1}{2}$in by $\frac{5}{64}$in. In a standard machine with a 65 deg C temperature rise the conductor would have an area six times as great.

Secondly, the power problem is quite different. In the case of an ordinary motor the designer can assume that current from the mains will be readily available and at relatively constant voltage, within fairly close limits. Various outputs can therefore be obtained from a given frame size by altering the number of conductors and so on.

Unfortunately, the designer of starter motors is not so happily placed. He must rely for his power on a car battery of, usually, 12 or 24 V, depending on the required output.

Consider for a moment the type and size of battery upon which the designer of starter motors has to rely. A size readily available for energizing heavy duty starters is from 150 to 200 Ah capacity at 12 or 24 V. If one takes out 200 A (Fig. 1) the voltage drops to 21·4 V and at 600, 1,000, 1,400 A discharge rates, the voltages will be 15, 8·6, 2·2 V respectively. In order to get the maximum output of the battery one cannot take out more than 750 A at 12·5 V, which means that whatever the starter design may be, its output will necessarily be limited to a portion of 9 kW (750 A × 12·5 V) because the starter motor efficiency has to be taken in account. It must be stressed that the operating voltage of the machine is much less than the nominal 24 V. The discharge curve of any battery is of course dependent on the state to which a battery is charged and also the temperature at which it is used. For example, in extremely cold countries the battery output will fall badly. The British designer works on the assumption that a battery may be only half charged and the temperature above freezing point and under those conditions the starter motor must function. In laboratories the designer uses a transformer-rectifier instead of a battery when testing the performance of starter motors, to replace the otherwise varying characteristics by fairly identical curves.

The momentary demand of a 6 h.p. 24 V starter motor is of the order of 1,000 A. The inner ohmic resistance of the battery

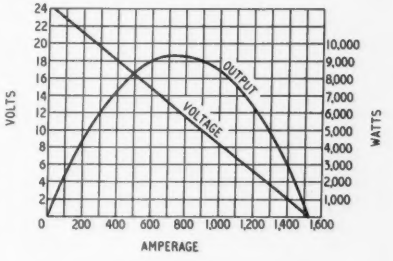


Fig. 1—Typical discharge characteristic curve of 24 V car battery

plus the total machine and lead resistances define this value, but it would be a bad procedure to try to save the battery from the shock by increasing the resistance of the motor and thus to reduce the starting current. The output of the machine would be affected, the speed reduced and, as a result, the firing of the engine delayed, or only achieved after several attempts. Consequently, the life of the battery would be considerably shortened.

For passenger and small commercial vehicles, the required output being comparatively small, the 12 V system is prevalent in this country whereas in America 6 V starters are used. But for heavy vehicles, like 5 ton trucks or double decker buses, in England as well as abroad, the 24 V system is generally accepted and an output of 6 h.p. has been found adequate in most cases. So far, in England and on the Continent, the starter motor of this power has been a four-pole machine. The armature slots in these larger machines (Fig. 2) are usually parallel sided with open tops, so that the wave wound coils can be pressed into position. Each slot usually contains two conductors and the latter have normally been wound from plain rectangular copper strips. Semi-closed slots, especially for smaller machines, are chosen to avoid the otherwise necessary bandages around the armature for keeping the conductors down. In this case the conductors are inserted from the side and, as a rule, are machine wound. Although the armature is, by mechanical means, protected against being driven to an excessive speed by the firing engine, a speed of approximately 7,000 r.p.m. should not affect the armature when the conductors are safely kept in position. Good insulation of the slots and the conductors is achieved by the use of leatheroid only, considering the low voltage between these parts.

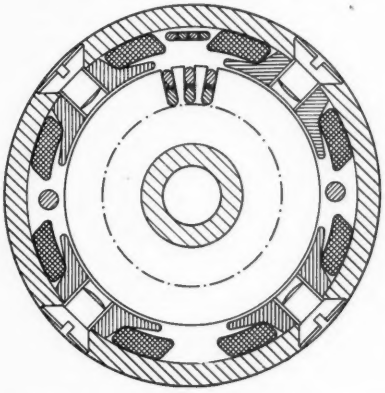
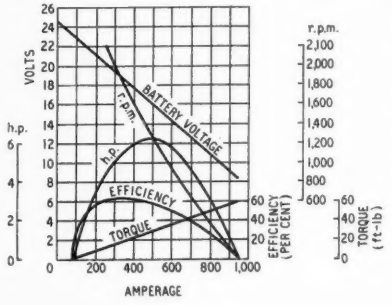


Fig. 2—Cross-sectional view of 4-pole starter motor

Fig. 3—Working diagram of a 6 h.p. 24 V starter motor



When selecting the number of slots and the conductors, it has to be kept in mind that the stalling torque has to be high for a quick breakaway. This fact, together with the effect on commutation, should favour the adoption of a fairly large number of slots. On the other hand, a great number of conductors increases the ohmic resistance, reduces the area of the magnetic flux and also keeps the speed down. For firing, the engine has to be brought to at least 80 r.p.m. As the pinion to rack ratio is about 1 : 13 the starter motor has to reach 1,100 r.p.m. A choice of between 33 to 37 slots has proved satisfactory for a 24 V machine.

The main field winding, like the armature winding, is also made from rectangular copper sections and is in series with the armature winding. All connections have to be firmly bolted together, to avoid unnecessary voltage drop across the joints. Some starters are equipped with additional shunt fields.

Another difference between an ordinary d.c. motor and a starter motor lies in the spring pressure of the brushes. On a starter motor, which may only run for a few seconds at a time, the brush pressure is kept much greater than on a standard motor which runs for many hours at a time. It must be kept in mind that the current involved here is extremely large and the unavoidable voltage drop, which works out to a high percentage of the battery

voltage, must be kept to its minimum. For example, a drop of 2 V across the brushes may represent only 0·5 per cent in the case of an ordinary d.c. motor, but 12 per cent in a 24 V system and 24 per cent in a 12 V system, since the actual working voltage is far below the nominal voltage, as already mentioned.

In Fig. 3, which is a working diagram of a 6 h.p. 24 V starter motor, battery voltage, speed, output, efficiency and torque are plotted against current. The starting torque is just under 60 ft-lb, which is sufficient for a quick breakaway. The speed of 1,200 r.p.m. at the peak of 6 h.p. output is already well over the required minimum of 1,100 r.p.m. (see above) and will still increase if the engine has not already been fired, as the line at which constant speed of the engine is reached is well over the maximum output and may be in the region of about 400 A. The efficiency of up to 60 per cent is fair for this kind of machine.

When we take a starter motor of identical dimensions for use on a 12 V system, we find conditions greatly changed as against 24 V. By selecting only 27 to 29 slots instead of 33 to 37, in order to get the required speed, the ohmic resistance is well reduced as the area of the conductors will also be greater, but the total voltage drop in the leads, the armature, the field and across the brushes is proportionately much greater than with 24 V. Although the capacity of the battery in Ah may be larger than with a 24 V system, the maximum output of the machine will not exceed 3 h.p.

As a result of investigations it has been found that a six-pole machine has a superior performance to that of the common four-pole machine. Thus, with a starter of only 5in diameter, a similar performance and larger output can be achieved, as compared with those of a four-pole 6in diameter machine. As the yoke of a six-pole machine requires to be of less cross-sectional area, due to the smaller flux, its thickness can be reduced, and therefore the armature diameter can be increased. As to the magnetic path, the relevant available area can generally be better utilized, especially the core section, which shows only small saturation in a four-pole machine. By slightly reducing the amount of conductors, i.e., slots, a copper section can be chosen to give the same, or even smaller, armature resistance. Although, in comparison with the 6in diameter machine the 5in diameter six-pole machine has to have a longer armature, its total weight will be considerably less. The saving of raw material only would not justify the abolition of the 6in machine. The desirable reduction of the dead weight of a vehicle and the possibility of improved design, together with the saving of raw material will, in my opinion, in due course result in the adoption of the six pole machine as a standard for heavy duty starter motors.

Street Lighting Equipment

THE "Concept" street lighting equipment made by Crompton Parkinson, Ltd., which was shown at the Association of Public Lighting Engineers' Conference exhibition, is being made in two types at present. The "Concept 1" for side road lighting with 100/200 W tungsten or 80/125 W mercury lamps incorporates a crystal prismatic glass bowl attached to a concrete head developed from the concrete bracket arm. It is supplied for use with Concrete Utilities "Estate Minor" columns with special brackets of either arc or swan neck types.

For main road lighting the "Concept 2" with either 85 W or 140 W sodium lamps has its light emission controlled by "Perspex" prismatic plates sealed to the inside of a self-cleaning open "Perspex" bowl. This bowl is attached to a concrete head developed from the concrete bracket so that there is no exposed metalwork other than the lamp-holder and the lamp supports within the bowl. If desired a hinged attachment with a "Perspex" dish can be fitted to the open bowl to give complete enclosure of the lamp against dust and weather. The bowl assembly can be supplied for use with Concrete Utilities 3 D or 3 DN columns with special Arc II brackets.

The Crompton "Concept 1" street lighting unit

NEW BOOKS

Worked Examples in Illuminating Engineering. By R. W. Ames, A.M.I.E.E., and J. B. Harris, A.M.I.E.E. Pp. 238; figs. 136; index. Macdonald & Co. (Publishers), Ltd., 16, Maddox Street, London, W.1. Price 21s.

This book will be of great value to a student preparing for the City and Guilds examination in illuminating engineering, provided he has a teacher, or some qualified illuminating engineer, to whom he can go in cases of difficulty. This proviso is necessitated by the fact that the answers given contain a number of statements which, if not actually wrong, can very easily be misunderstood by a student working alone. There are, too, some errors which may well confuse a student although of no consequence to anyone familiar with the subject.

A very unfortunate example occurs in problem 39, "Describe some form of practical photometer of physical type," where the answer begins with the statement, "A practical photometer of the physical type is a portable instrument used for the measurement of illumination, and depends for its operation on the visual comparison of brightnesses." There follows a good description of the luxmeter.

The book covers both the Intermediate and Final Grades and the majority of the questions are naturally taken from C. & G. papers. There are also some from other examinations and a number of well-constructed problems cover parts of the syllabus for which, presumably, no examination questions were available.—J.W.T.W.

Energy Retrospect. By J. H. M. Sykes, Associate I.E.E. Pp. 46. Garraway, Ltd., 11a, Kensington Church Street, London, W.8. Price 6s 6d.

In a foreword to this little book, Sir Arnold B. Gridley, M.I.E.E., M.P., draws attention to the possibly serious consequences of efforts now being made to discourage the use of electricity for cooking and space and water heating and to encourage private industrial generation. The specious arguments advanced for such retrograde proposals are capably met by the author in a readable, popular review of to-day's energy problems as seen about 50 years hence by two graduates preparing doctorate theses. At that time electricity is assumed to be freely available from atomic sources supplemented by wind and water, including tides, coal being used, or exported, solely in the form of chemical products.

While one candidate seeks to justify the opinions of those who, as things were, advocated shortsighted measures, such as the general adoption of solid fuel appliances, the other deals faithfully with the fallacies underlying these assumptions, pointing out that there were also more knowledgeable and thoughtful people who took longer term, and as it proved, more practical views. He also covers in a well-informed way questions arising out of power supply, including wastage in coal transport, public and private generation and misconceptions regarding load factor.—C.O.B.

Electrical Measurements. By F. Harris. Pp. 784; figs. and index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 64s.

The importance to the electrical engineer of a sound knowledge of the more common methods of measuring the basic electrical parameters has been appreciated by many technical colleges, which have accordingly incorporated this subject in their curricula.

Many engineers are still unaware, however, of the theoretical and practical limitations of the overall accuracy obtainable with a particular method of measurement, or the precautions which should be taken to ensure the greatest possible accuracy in the final result. Thus one frequently sees measurements on a capacitance of about 1 μF stated to six significant figures, when the calibration of the standard with which it is compared cannot, in general, be known to better than 0·01 per cent.

It is therefore quite a refreshing experience to read a book on this subject in which the limitations of the standards and measuring circuits are recognized and kept fully in mind. The text, which covers a wide range of subjects and is necessarily detailed, gives ample references to original papers for further information.

In order to illustrate current instrument design, the circuit arrangements of typical commercial instruments are described. The author, who is obviously an authority, has produced a book which should become a standard work.—H.B.W.

VIEWS on the NEWS

By REFLECTOR

I AM afraid that while load spreading is feasible among industrial consumers, appeals to domestic users to abstain from using electricity at peak periods must inevitably result, if heeded, in a reduction in consumption rather than a change of habit. Meal times are not readily altered and the housewife naturally does not wish to begin clothes washing in the afternoon or evening. This problem came before the East Midlands Electricity Consultative Council last week when concern was expressed at the decrease in electricity sales. It was felt that confusion still existed between peak economy and fuel economy, and emphasis was laid on the fact that the coal used in power stations was of a low grade unsuitable for export and for carbonizing. A warning was given that unless the tendency for consumers to save electricity outside the peak hours was checked it must result in a general increase in charges.

* * *

The headline " B.E.A. Deficit " in the news this week must have made some people wonder whether the Authority's report, expected shortly, had been published earlier than expected and that it belied the forecasts of a small profit. The initials, of course, referred to the other B.E.A.—the British European Airways Corporation. I was pleased to see that the *Daily Telegraph* overcame the ambiguity by referring to the B.E.A.C.

* * *

Many uncomplimentary things have been said about Electricity Boards which, by requiring guarantees or capital contributions, have sought to ensure that mains extensions to new consumers shall not be a burden on existing users. The *Inverness Courier* is not among these critics. It slates the " grumblers of Glen Urquhart and elsewhere " who have complained at the North of Scotland Hydro-Electric Board's " entirely reasonable " request that would-be consumers should guarantee a minimum annual payment for seven years. The Board, it says, is not likely to waste time wooing its opponents . . . who will have only themselves to blame if they find themselves denied power and light when they finally declare themselves ready and willing to accept the blessings of electricity. I have no doubt that some of the Boards in the South would be glad to have such staunch support for their similar actions.

* * *

At a time when gas lighting is giving place to electricity everywhere it is astonishing to learn from a brief note in the Dublin *Evening Herald* that Limerick Corporation had a plan to replace electric street lights by gas lamps in some areas. Apparently the plan may now be abandoned " because of the high cost of tubular steel gas-lamp standards." Thus will Limerick be saved from eccentricity.

* * *

My recent note on " topical " names has attracted another letter, this time from a correspondent, an electrical engineer, whose wife, appropriately enough, was given the name Eda. It cannot however be said that the name was derived from any association with the electrical industry for I am told that she was named after an aunt who was so christened 90 years ago, long before the E.D.A. came into existence.

* * *

Addressing an audience in London recently the Dean of Canterbury spoke of the improved labour conditions in China. He quoted as an example a woman worker in a factory making " little electric torches." To-day, said the Dean, she was paid 16 lb of rice a day whereas she formerly received 3½ lb. I should say that she is now grossly and uncomfortably overpaid.

PERSONAL and SOCIAL

News of Men and Women of the Industry

OWING to ill-health **Mr. M. A. Bulloch,** A.M.I.E.E., A.C.G.I., has tendered his resignation as chairman of the South Eastern Electricity Consultative Council. Mr. Bulloch, who by virtue of his chairmanship was also a member of the South Eastern Electricity Board, was appointed in October, 1948. Before his appointment he was a member of the Wimbledon Corporation and chairman of the Electricity Committee, and a member of the London and Home Counties Joint Electricity Authority.

The Minister of Fuel and Power has appointed **Commander D. S. E. Thompson,** R.N. (ret.), C.C., as chairman of the Council with effect from 1st October. Commander Thompson became a member of the Council in November, 1948, on the nomination of the Kent County Council.

Mr. J. W. Thomas, director of training, safety and welfare, British Electricity Authority, retired at the end of September on reaching the age of sixty-five. He has had a long association with the electricity supply industry. After leaving Manchester University with the degree of B.Sc.Tech., he served under Sir Leonard Pearce as a student apprentice with the Manchester Corporation Electricity Department, and also as junior engineer at Stuart Street power station. He was for five years with the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, and afterwards was a lecturer in electrical engineering at the Birmingham Technical College. Mr. Thomas was one of the founders of the Electrical Power Engineers' Association, and from 1920 to 1931 was its assistant general secretary as well as technical editor of the *Electrical Power Engineer.* While with the Association, he obtained the degree of LL.B. at Manchester University, and was called to the Bar. He subsequently became secretary of the British Engineers' Association.

Mr. J. W. Thomas

In March, 1948, Mr. Thomas accepted the position of education and training officer with the B.E.A. and one year later was appointed director of training, safety and welfare. Mr. Thomas will not be severing entirely his connection with the industry as he has accepted the position of part-time secretary of the Association of Managerial Electrical Executive, the organization catering for managerial staffs in the industry.

Mr. Allen G. Clark, chairman of the Plessey Co., Ltd., and **Mr. W. H. Newton,** M.A., F.C.A., chairman of Serck Radiators, Ltd., and director of other companies, have been appointed additional directors of National Plastics, Ltd.

Mr. F. D. Pratt has been appointed chairman of Simpson, Baker & Co., Ltd., following the retirement of **Mr. A. C. Baker,** who, however, remains a director. Mr. Pratt is a director of Edmundsons Electric Co., Ltd., Alliance Wholesale, Ltd., and the Sloan Electrical Co., Ltd. **Mr. G. H. Bowles,** a director of Simpson, Baker & Co., Ltd., has been appointed general manager of the company.

Sir Vincent and **Lady de Ferranti** recently flew from London Airport by B.O.A.C. "Comet" jet air liner to Rome, where Sir Vincent was to attend as chairman of the International Executive Council of the World Power Conference.

Balfour, Beatty & Co., Ltd., announce that **Mr. O. M. White,** A.M.I.C.E., M.I.E.E., chief electrical engineer, has been appointed a director of the company.

Mr. J. N. Dean, managing director, and **Mr. B. H. Musgrave,** director, of the Telegraph Construction & Maintenance Co., Ltd., left London by air for South Africa on 25th September to study market conditions. They will visit Cape Town, Salisbury and Johannesburg, including the headquarters of the subsidiary company, Telcon Cables (S.A.) (Pty.), Ltd. They are returning at the end of this month.

Mr. G. E. Mottram, Associate I.E.E., has been appointed north western area sales manager for British Klockner Switchgear, Ltd., and will be in charge of the new branch office at 22, Booth Street, Manchester, which was opened on 1st October. For the past

seven years, Mr. Mottram has been plant sales engineer for Crompton Parkinson, Ltd., in this area, before which he served with Lancashire Dynamo & Crypto, Ltd., as contracts engineer.

The Minister of Fuel and Power has appointed **Sir George Thomson,** F.R.S., to be a member of the Scientific Advisory Council which was set up in 1948 to advise him on the scientific aspect of his statutory duties. Sir George Thomson is late Professor of Physics at the Imperial College of Science and Technology and has recently been appointed Master of Corpus Christi College, Cambridge. He is holder of a Nobel Prize. **Sir Charles Goodeve** and **Professor S. Zuckerman,** C.B., F.R.S., have ceased to serve on the Council. Sir Charles has resigned because of other commitments. Professor Zuckerman's term of office has expired.

The **Falcon Association,** an organization for past apprentices of the Brush Electrical Engineering Co., Ltd., held its third annual reunion at Loughborough on 19th and 20th September and it was attended by 125 members. The programme started with an informal reception at the works when the past students and other friends were taken on conducted tours, after which the annual meeting was held. Mr. J. W. C. Milligan was re-elected president and Mr. J. H. R. Nixon chairman. Mr. E. Padmore was elected the new hon. secretary, and Mr. Lewis Hart hon. assistant secretary. On Friday evening the delegates attended a ball at the Empire Ballroom, Loughborough, organized by the Brush Students' and Apprentices' Association. On Saturday there was a golf tournament between the Brush Golfing Society and the Falcon Association, which was won by the former, and a Rugby match between a Brush team and the Falcon Association, which was won by the latter.

The annual dinner of the Association was held at the Grand Hotel, Leicester, under the chairmanship of Mr. J. W. C. Milligan, at which the principal guests were Mr. H. E. Knight, chairman elect of the East Midlands Centre of the Institution of Electrical Engineers, and Dr. H. L. Haslegrave, principal of the Leicester College of Technology. The board of the Brush Electrical Engineering Co., Ltd., was represented by Mr. F. R. M. De Paula.

The Brush annual research fellowship has this year been awarded to **Mr. A. R. Wade,** who was from January, 1947, to February, 1949, a Brush student apprentice. The value of the fellowship is £400 per annum, tenable at a British university.

Mr. Charles Carpenter, traffic manager of Cable & Wireless, Ltd., sailed from Southampton on Wednesday last for Buenos Aires to join the British delegation to the International Telecommunications Plenipotentiary Conference, of which he is a member. The object of the Conference, at which more than seventy countries will be represented, is to revise the current International Telegraph Convention, drawn up at Atlantic City in 1947.

Mr. W. R. Coleman, A.I.E.E., M.S.M.A., has resigned from the management of the Arora Company, Loughborough, and his address is 75, Hilton Lane, Prestwich, Manchester.

Mr. N. R. Wheldon has resigned his position as sales manager of Crypton Equipment, Ltd. (incorporating Lancashire Dynamo Switchgear, Ltd.), and has been appointed sales engineer in the London area for G. P. Dennis, Ltd. Mr. Wheldon will work from the Dennis Switchgear London office at 417, Grand Buildings, Trafalgar Square, W.C.2. **Mr. C. Baker** has also joined Dennis Switchgear and will be in charge of all sales in the Midlands area, working from Shustoke Green, Nr. Coleshill, Warwickshire. Mr. Baker was until recently with Bill Switchgear, Ltd.

Mr. N. R. Wheldon

The new Luton branch manager of Enfield Cables, Ltd., is **Mr. J. F. Parnell,** who has been a senior sales representative at the London branch of the company for many years. The Luton branch address is 15, Chapel Street, Luton (telephone : Luton 4234).

Mr. W. A. Last, electrical buyer of Kelvin & Hughes, Ltd., Barkingside Works, has taken up a similar appointment with S. Smith & Sons (England), Ltd., of Bishops Cleeve, Cheltenham, as from 1st October.

Miss H. M. Hartop, who for many years was senior demonstrator with the London Electricity Board, West Ham District, has joined the staff of the Revo Electric Co., Ltd., as senior demonstrator.

Lord Latham, chairman, and the other five members of the London Transport Executive, whose appointments expire on 30th September, have been re-appointed for the further term of one year.

At a ceremony in London last week the Minister of Fuel and Power (Mr. G. Lloyd), on behalf of the Queen, presented 32 workers in the fuel and power industries with the British Empire Medal. Among the recipients were :—Mr. E. Belshaw, electrician, North Western Electricity Board; Mr. A. Dean, foreman, turbine room (shift), South Eastern

Division; Mr. P. W. J. Matthews, building foreman, Hayle power station, South Western Division; Mr. W. C. Neville, charge hand carpenter, Southern Electricity Board; Mr. W. J. Packer, yard charge hand, Merseyside and North Wales Electricity Board; Mr. F. Usher, auxiliary plant attendant, North Eastern Division; and Mr. A. Wilson, foreman fitter, S.E. Scotland Division.

Mr. F. S. Bowen, of Manchester, has been elected president of the Engineer Surveyors' Association for 1952-53, and **Mr. J. G. F. Carrol,** London, has been elected vice-president.

The Council of the Institute of Metal Finishing announces that on the recommendation of the Publications Committee, the Westinghouse Brake & Signal Co.'s prize is to be awarded to **Mr. W. A. Marshall** for his paper on "Non-Electrolytic Smoothing Treatment for Steel." The Council has decided that no paper in the field covered by the terms of the Johnson Matthey Silver Medal award has been received to warrant its being presented this year.

Mr. E. D. Broom, previously manager of the Southampton branch of Simms Motor Units, Ltd., has now been appointed manager of the Birmingham branch. **Mr. C. C. Duncombe,** previously manager of the Plymouth branch, is now branch manager at Southampton, and **Mr. R. E. Martinson,** previously an outside representative at the Bristol branch, becomes branch manager at Plymouth. **Mr. R. W. R. Keyes** was recently appointed an outside sales representative on the staff of the Kilburn branch.

Mr. John H. Appleby, A.M.I.E.E., A.M.I.Mech.E., chief engineer, Punjab, Public Works Department Electricity Branch, left Karachi on 1st October on M.V. *Cilicia*, on three months' leave and is due to arrive at Liverpool on 20th October. During his stay in this country he can be contacted at White House, Abberton, Colchester.

Mr. H. S. Payman, B.Sc., M.I.E.E., M.I.R.E., is shortly relinquishing his position as general manager of A.B. Metal Products, Ltd., to take up an appointment as joint managing director of Hawk, Ltd., Treforest. Mr. Payman was formerly deputy director of Communication Components Production, Ministry of Aircraft Production.

The first annual sports day of the **Yorkshire Electricity Board** Headquarters Recreation Club was held at Scarcroft on 13th September, about 250 members of the staff, their families and friends attending. Mr. Dennis Bellamy, the Board's chairman, performed the opening ceremony after which the crowd watched the finals and semi-finals of tennis, bowls and putting matches. Children's races, adult novelty races and a tug-of-war followed. Prizes were presented to all the competitors in the children's events by Mrs. A. Bond, wife of the deputy chairman. Mrs. D. Bellamy presented the prizes to the winners of the adults' events. An arts and crafts exhibition was open throughout the afternoon, and in the evening a dance was held in the dining room.

A very pleasant evening was spent at Victoria Halls, Holborn, on 24th September when **L.E.S. Distributors, Ltd.,** held their annual staff dance. Well over 200 people attended, and a number of prizes were distributed.

Lively performances of William Douglas Home's farce "Master of Arts" were given by the **Portland Players** (B.E.A. Sports and Social Club) on Wednesday and Thursday last week at the Cripplegate Theatre, London, E.C.1. Clifford Coffee sustained the non-stop part of a housemaster at an English public school with great aplomb, and the rest of the company ably backed him. It is probably unfair to single out any individual, but Stuart Rix, in impenetrable disguise as the Duke of Fernyrigg, was much appreciated. The other members of the cast were Philip Davies, William Rowland, Anthony Moss, James Rintoul, Gloria Henshaw, June Dobbs, Margaret Cornish and Renee Futcher. The production was by Mrs. E. M. Manning, whose services were recognized in a presentation made at the conclusion of the second performance.

The **Association of Supervising Electrical Engineers** is advertising in this issue inviting applications for the position of general secretary of the Association.

OBITUARY

Mr. W. H. W. Urquhart.—The death occurred on 27th September at the age of fifty-one of Mr. William Herbert Walton Urquhart, manager of the Glasgow office of C. A. Parsons & Co., Ltd., since 1947. Previously he served for a number of years with Andrew Yule & Co., Ltd., in India.

Mr. A. Brammer.—A memorial service to the late Mr. Albert Brammer, general secretary of the Association of Supervising Electrical Engineers, was held on 24th September at the Queen's Chapel of the Savoy, Strand, London, W.C.2, and was attended by representatives from all branches of the electrical industry. The Rev. H. Hipkin, vicar of St. Andrew's Church, Southgate, gave an appreciation of Mr. Brammer's work and character.

WILLS

Mr. G. A. Juhlin, M.I.E.E., formerly chief electrical engineer of the Metropolitan-Vickers Electrical Co., Ltd., who died on 31st December, aged seventy-one, left £18,303 gross (£18,142 net).

Mr. A. J. Foster, managing director of Edward Wilcox & Co., Ltd., who died on 11th July, left £6,604 gross (£6,476 net).

Institution Centres

Chairmen for the 1952–53 *Session*

IN our issue of 19th September we published the portraits, together with biographical notes, of the chairmen of the specialized sections of the Institution of Electrical Engineers. We now give below brief notes on the men who will preside over the meetings of the local Centres.

MR. H. E. KNIGHT (East Midland Centre) is chief electrical engineer of the tube works of Stewarts & Lloyds, Ltd., Corby. He was educated at Oundle and the Rugby College of Technology and Arts, and received his engineering training with the British Thomson-Houston Co., Ltd., Rugby. In 1933 he joined Stewarts & Lloyds and in the same year was commissioned in the Supplementary Reserve, Royal Signals. He served throughout the last war in the campaigns in France/Belgium, North Africa and Italy. Mr. Knight, who is a member of the Northants County Council, has taken a keen interest in technical education and is chairman of the County Secondary Education Committee. He also represents the county on various committees concerning technical education in the East Midlands. He is the author of various articles and papers dealing with heavy industrial electrical installations and last session read a paper before the East Midland Centre of the I.E.E. on "The Reconstruction of the Italian State Telecommunications System 1943–45."

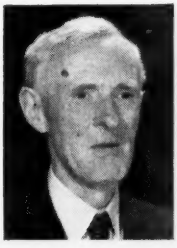
MR. W. A. HATCH, M.B.E., A.M.I.C.E., A.M.I.Mech.E. (Mersey and North Wales Centre) was educated at Dulwich College and received his technical training with the Mersey Docks and Harbour Board, and with Dick, Kerr & Co. He was assistant engineer to the North-Eastern Electric Supply Co., Ltd., and later assistant engineer to Burstall & Monkhouse before joining Pilkington Bros., Ltd., St. Helens, with whom he holds the position of electrical engineer.

MR. H. LEYBURN, B.Sc. (North-Eastern Centre) is head of the Research and Certification Department of A. Reyrolle & Co., Ltd. He received his engineering education at King's College and at the City and Guilds College (London). After a few years with the B.T.H. Co., and Ferguson, Pailin, Ltd., he joined Reyrolle's in 1927. He first concentrated on protective gear research and development in what was then known as the Technical and Research Department and became section leader in 1932. In 1938 he was promoted to deputy head of the Department and in 1948 to his present position. He is sole or joint inventor of over fifty patents. Mr. Leyburn has been a member of B.E.A.M.A., B.S.I., E.R.A., and I.E.E. Committees, and still is a member and chairman of some of them. He is a joint author of two I.E.E. papers, which were awarded the Ayrton and the Sebastian de Ferranti premiums respectively, and also of papers presented to the C.I.G.R.E.

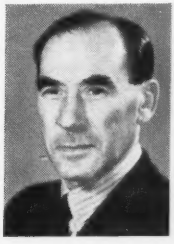
MR. H. S. MOODY (North Midland Centre) received his engineering training at the City and Guilds Engineering College

Mr. H. E. Knight

Mr. W. A. Hatch



Mr. H. Leyburn



Mr. H. S. Moody

and as a student apprentice with the Western Electric Co. In 1926 he joined the Yorkshire Electric Power Co. as an assistant mains engineer, later becoming a district engineer. In 1929 he transferred to research work with the International Telephone and Telegraph Laboratories Inc. and in 1930 he joined the then newly-formed J. L. Eve Construction Co., Ltd., as a construction engineer. From 1934 to 1940 he was with Standard Telephones & Cables, Ltd., where he was in charge of the Power Cable Engineering Department and later the corresponding Installation Department. Mr. Moody returned to the Yorkshire Electric Power Co. as assistant mains superintendent and subsequently became technical assistant to the general manager. At vesting date he was appointed a section head in the Chief Engineer's Department of the Yorkshire Electricity Board, which position he still holds. He is a past hon. secretary of the North Midland Centre and also a past chairman of the Yorkshire Branch of the Engineers' Guild.

Mr. J. Prince

Mr. H. Weston

Mr. J. S. A. Primrose

Mr. Prince (North-Western Centre) is manager of the Meter Department of Ferranti, Ltd. He served in the designs offices of the Peel Connor Telephone Co. and Salford Electrical Instruments, Ltd., before joining Ferranti's in 1926, taking charge of the meter drawing office in 1931. In 1935 he was appointed chief engineer of the Meter Department and in 1939 manager of the same Department. He served on the I.E.E. N.W. Centre Committee from 1938 to 1941, on the Measurements Section Committee (London) from 1944 to 1947, and was re-elected to the N.W. Centre Committee in 1948. He is also a member of the B.E.A./B.E.A.M.A. Joint Sub-Committee on Meters.

Mr. H. Weston (Northern Ireland Centre) is superintendent of power stations with the Belfast Corporation Electricity Department. He was with the Cleveland and Durham Power Co. before going to Belfast in 1923.

Mr. J. S. A. Primrose, M.Cons.E. (Scottish Centre) is sole partner in the firm of Ramsay and Primrose, consulting engineers, Glasgow. He was educated at Kelvinside Academy and the Royal Technical College, Glasgow. In 1930 he joined partnership with Alexander Ramsay, Glasgow, and became sole partner in 1949. He has specialized in the development of low temperature electric heating systems of buildings and the design of steam boiler plant for process work, central heating, domestic hot water, ventilation, and electrical work for hospitals and other large buildings. He is a past president of the Glasgow Electrical Society.

Mr. K. R. Sturley, Ph.D., B.Sc. (South Midland Centre) has been head of the B.B.C. Engineering Training Department, Wood Norton, Evesham, since 1945. He was educated at George Dixon Secondary School, Birmingham, and Birmingham University. He was awarded the Bowen Research Scholarship to pursue investigation on electro-thermal storage problems which led to the Ph.D. degree. He has always been associated with telecommunications, first at Marconi's as research engineer, then as engineer with Associated Electrical Industries, Ltd., at its valve factory at Brimsdown. He rejoined Marconi's in 1936 as lecturer at Marconi College, and later became assistant principal. He received I.E.E. premiums—Students' and

Dr. K. R. Sturley

Cdr. (L.) J. C. Turnbull

Fleming (twice)—for a "Review of Broadcast Receivers," with others, and for "Frequency Modulation." He is the author of a number of papers on circuit theory, of a monograph on frequency modulation, and of a text-book "Radio Receiver Design." He was chairman of the South Midland Radio Group for the year 1949–50.

COMDR. (L.) J. C. TURNBULL (Southern Centre) was educated privately and at Dover College, and received his technical education at Birmingham Technical College and the Rugby College of Technology and Arts. He served as an engineering apprentice with the British Thomson-Houston Co., Ltd., after which he was with Higgs Motors, Ltd. (1930–34), Laurence, Scott & Electromotors, Ltd. (1934–35) and the Midland Electric Manufacturing Co., Ltd. (1935 to outbreak of war). He joined the Royal Naval Volunteer Supplementary Reserve in 1937 and in 1939 was commissioned in the R.N.V.R., serving as assistant torpedo officer in destroyers and H.M.S. *Illustrious* until May, 1943, when he was promoted electrical lieutenant commander and served in the Admiralty (Bath), the invasion of Normandy, and in Western Approaches, to the end of the war. He was promoted acting electrical commander R.N.V.R. in 1945, transferring to the Royal Navy and being promoted commander (L.) in 1946. He is now serving in the Naval Electrical Department, Admiralty, Bath.

MR. A. C. WARREN, B.Sc. (Western Centre) is chief regional engineer, South Western Region, G.P.O. He was educated at the City and Guilds Engineering College, and was awarded the diploma of the Imperial College for research on radio. He entered the Post Office Engineering Department in 1920 and has held the successive positions of assistant engineer and executive engineer, Radio Branch, Engineer-in-Chief's Office, London (1920–35), assistant superintending engineer, South Western District (1936–37) and telephone manager, Bristol (1937–44). He was appointed to his present position in 1944.

Prospects in Paraguay

THE trade of Paraguay is not large, both imports and exports being limited by the small population of the country (1950 census 1,405,627). Argentina is the most important trade partner of Paraguay, other importing countries being the United States, the United Kingdom and sterling area, Brazil, Sweden and Uruguay, in that order of importance. In his report on the economic and commercial conditions in Paraguay (H.M. Stationery Office, 2s net) Mr. I. L. Henderson, H.M. Ambassador and Consul-General at Asunción, says that the United Kingdom has been regarded as a traditional supplier of certain manufactured goods which enjoy a reputation for quality, and United Kingdom business methods are highly esteemed in Paraguay. Agricultural equipment, machinery for certain industries, building materials and consumer goods of a non-luxury nature, all find a small but ready market. In 1951 imports of electrical goods and apparatus from the United Kingdom were valued at £58,065, as compared with only £8,335 for 1950.

The tremendous outlay of capital required for the development of the hydro-electric resources in Paraguay, and the small extent of the industrialization of the country, have so far prevented any schemes from being carried out. A part of the "Point Four" Plan agreement in Paraguay includes a study of hydro-electric schemes.

Before assembling at Southport for their summer visit, a group of members of the I.E.E. Supply Section visited the Hollinwood and Moston factories of Ferranti, Ltd, on 25th September. Our picture shows the party grouped in front of the offices of the new transformer factory at Hollinwood.

I.E.E. LONDON MEETINGS

Programme for the first half of 1952–53 *Session*

ON Thursday next the 1952–53 Session of London meetings of the Institution of Electrical Engineers opens at the Institution Building, Savoy Place, W.C.2, when Col. B. H. Leeson will deliver his inaugural address as President. As we have done in previous years, we give below the meetings for the first half of the session, arranged under their respective headings for convenient reference.

ORDINARY MEETINGS

9th October: Inaugural address as President by Col. B. H. Leeson. 6th November: "Telemetering for System Operation," by R. H. Dunn and C. H. Chambers. (Measurements Section paper.) 4th December: "Economic Aspects of Overhead Equipment for D.C. Railway Electrification," by O. J. Crompton and G. A. Wallace. 8th January: "Nuclear Reactors and Applications," by Sir John Cockcroft, followed by Symposium of Papers on "Nuclear Reactor Instrumentation."

INFORMAL MEETINGS

20th October: Discussion on "The Institution and Current Affairs," opened by the President. 17th November: Discussion on "The Field of Application of Metal Rectifiers," opened by S. A. Stevens. 8th December: Discussion on "The Maintenance of Electrical Equipment," opened by R. H. Cobbold. 19th January: Discussion on "The Parallel Running of Private Generating Plant with the Grid System," opened by E. R. Wilkinson.

EDUCATION DISCUSSION CIRCLE

14th October: Discussion on "The Teaching of Chemistry to Engineers," opened by Dr. J. E. Garside. 10th November: Discussion on "The Teaching of Illumination Engineering," opened by S. S. Beggs. 10th December: Discussion on "The B.B.C. School, Evesham" and "The Post Office School, Stone," opened by Dr. K. R. Sturley and H. R. Harbottle. 21st January: Discussion on "Some Difficulties in the Teaching of Electrical and Mechanical Resonance," opened by C. T. Baldwin and J. C. Oakden.

MEASUREMENTS AND SUPPLY SECTIONS

26th November: "The Electrolytic Analogue in the Design of High-Voltage Power Transformers," by D. McDonald. 9th December: "Voltage Transformers and Current Transformers Associated with Switchgear," by W. Gray and A. Wright.

MEASUREMENTS AND RADIO SECTIONS

18th November: "Harmonic Response Testing Apparatus for Linear Systems," by D. O. Burns and C. W. Cooper. 6th January: "An Improved Scanning Electron Microscope for Opaque Specimens," by D. McMullan.

RADIO SECTION

15th October: Chairman's address, by Dr. E. C. S. Megaw. 27th October: Discussion on "The Impact of Television on Sound Broadcasting," opened by G. Parr. 12th November: "Radio Telemetering," by E. D. Whitehead and J. Walsh. 24th November: "Recent Progress in Radar Duplexers, with Special Reference to Gas-Discharge Tubes," by P. O. Hawkins. 3rd December: "A Survey of Present Knowledge of Thermionic Emitters," by D. A. Wright. 15th December: Discussion on "How to Plan a Radio Project," opened by Dr. J. Thomson. 14th January: "Printed and Potted Electronic Circuits," by G. W. A. Dummer and D. L. Johnston. 26th January: Discussion on "The Relative Merits of Harmonic and Intermodulation Measurements for Assessing Distortion in Audio Equipment," opened by E. W. Berth-Jones.

SUPPLY SECTION

29th October: Chairman's address, by C. M. Cock. 17th December: "Uses of Earthed Signal Conductors on Transmission Circuits," by W. Casson. 28th January: "Some Researches on Circuit Breaking by means of High-Voltage Circuit Breakers, with Special Reference to Current Chopping," by A. F. B. Young.

MEASUREMENTS SECTION

21st October: Chairman's address, by Dr. L. Hartshorn. 4th November: Discussion on "Circuit Applications of Cold-Cathode Trigger Tubes," opened by K. Kandiah. 11th November: Section dinner (at the Cafe Royal). 2nd December: Discussion on "Recording Instruments," opened by W. Bamford. 20th January: Discussion on "Measurements of Magnetic Permeability," opened by Dr. A. J. King.

UTILIZATION SECTION

23rd October: Chairman's address, by Dr. J. W. T. Walsh. 20th November: "Electricity in Farm Crop Drying," by C. A. Cameron Brown and P. G. Finn-Kelcey. 11th December: "The Royal Festival Hall: Electrical Installation," by J. G. Hunter. 13th January: Section dinner-dance (at the Criterion). 22nd January: Particulars to be announced later.

EXTRA MEETING

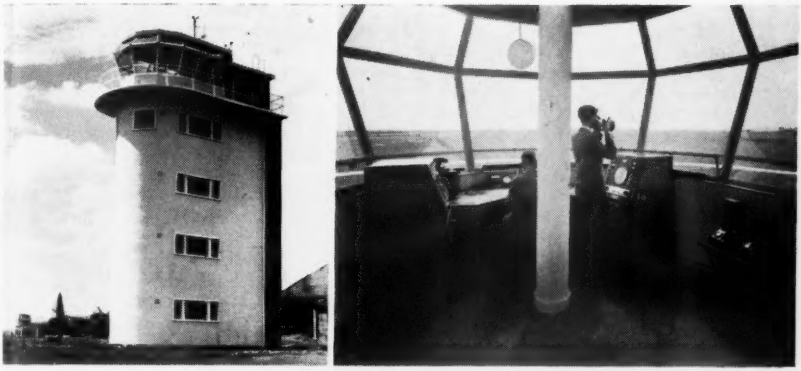
13th November: "A 150 kV X-ray Equipment for the Radiography of Circumferential Welds in Gas-Turbine Rotors," by F. W. Waterton.

Scottish Illumination Design Course

THE Scottish Lighting Service Bureau is holding an evening illumination design course at the Grand Central Restaurant, Jamaica Street, Glasgow, C.1, from 15th October to 19th November. All the meetings will be held on Wednesdays, except that on 6th November (Thursday). Applications for seats should be made to Mr. J. Roper at the Bureau, 29, St. Vincent Place, Glasgow.

Luton Airport

New Control Tower Opened



The new control tower at Luton Municipal Airport and (right) interior of the control room

THE Minister of Transport and Civil Aviation, Mr. A. T. Lennox-Boyd, last week officially opened a new control tower at Luton Airport. The tower, which has a commanding view of the entire airfield and gives a full view of the approach to all landing runs, is four storeys high and has an overall height to roof level of 52ft 6in. The ground floor will be used as a reception room, the first floor is to be developed in the future as a meteorological office, while the second floor will be used as a records office and teleprinter room. The main v.h.f. R/T equipment is situated on the third floor together with a stand-by battery plant.

In the control room, at the top, there is transmitting and receiving equipment for v.h.f. R/T, as well as a Marconi AD.200 v.h.f. D/F apparatus, together with telephones, crash alarms, and wind speed and direction indicators, all of which equipment has been built into the control officer's desk which faces directly on to the airfield. The control room window is arranged so as to eliminate any possibility of reflection when night flying equipment is in use. By spraying the ceiling of the control room with tinted Pyrok, day glare has been cut down and at the same time acoustic insulation is provided.

All telephone, electric lighting and other cables are concealed in a duct running from the switchgear room on the ground floor to the various offices in the building. The aerials for the v.h.f. R/T communication and the equipment for the wind speed and direction indicators are on the roof. From the control room floor, exit doors are provided to each side of a balcony extending round the entire control room, which is of concrete construction.

The building was designed in the Borough Engineer's Department and constructed by David Chaston, Ltd., the electrical installation being carried out by the Scientific Radio & Electrical Services, Ltd.

Television in Ulster

AN action committee, representing the Ulster radio and electrical trades, has been formed to expedite the introduction of television to the Province. The committee will canvass the support of M.P.s both at Westminster and Stormont. As the result of initial moves, it has been suggested to the Assistant Postmaster-General that a temporary Northern Ireland transmitter be erected for the Coronation, and this is receiving consideration. The committee points out that television is urgently needed in Ulster if the radio trade is to maintain present employment.

Electrical Geography

International Power Exchanges

WITH the object of achieving ultimate balance between power resources, a committee of the Economic Commission of Europe has collated data regarding potential transfers of electricity across frontiers in documents E/ECE/EP126, 128 and 151.

The two main sources of power, water and coal, the reports state, occur in three zones. The first comprises Iceland, Northern Scotland, Norway, Sweden and Finland, where economically exploitable hydro-electric potential is estimated to be 170,000 million kWh per annum, 35 per cent of that for the whole of Europe; coal is only 0·1 per cent.

The second zone, in southern Europe, covers the Iberian peninsula, south and south-west France, Switzerland, Austria, Italy and west Yugoslavia; water power potential amounts to about 240,000 million kWh per annum or 49 per cent of the European total; coal deposits (mainly in Spain) form only 1·4 per cent of European reserves and brown coal about 8 per cent; there are also geothermal and natural gas potentialities in Italy.

Thermal Zone

The central zone between these two includes Ireland, Great Britain, northern France, Belgium, the Netherlands and the Ruhr, Germany, Poland, Czechoslovakia, eastern Austria and Hungary, and Silesia, and contains 98 per cent of the hard coal and 90 per cent of the brown coal of Europe; water resources are poor. Broadly, the general layout of European transmission lines has been dictated by the existence of the central thermal zone between the two hydro zones.

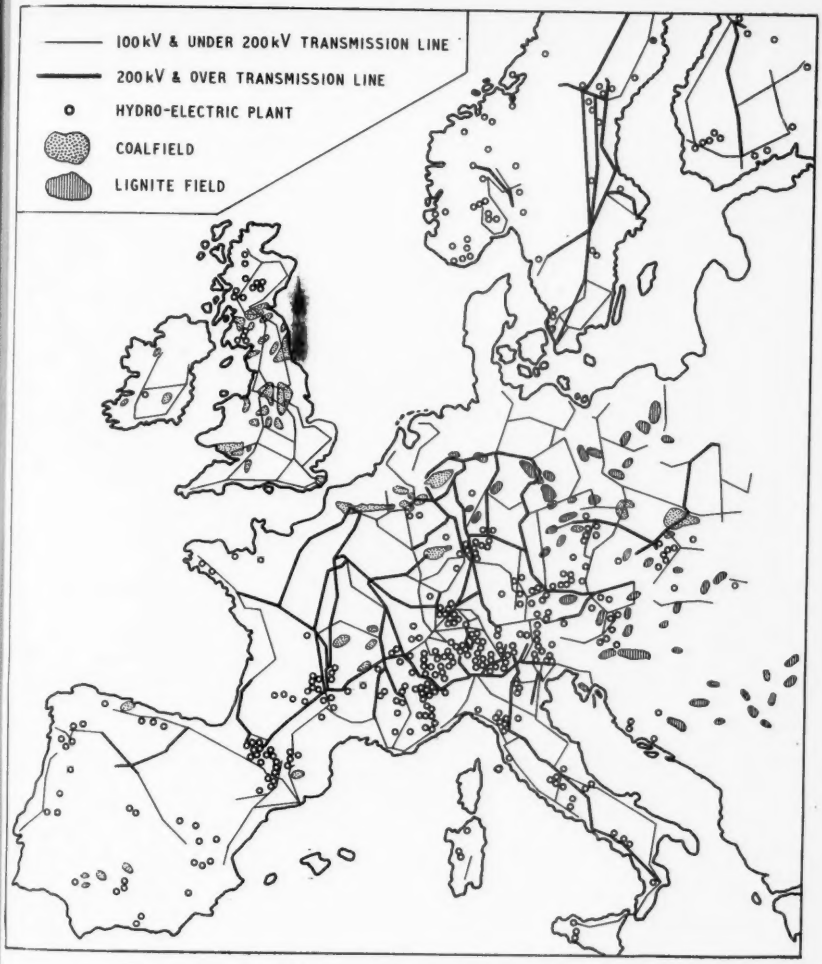
Hydro plants are classified as: run-of-stream, which have no storage basin that takes longer than two hours to fill; daily or weekly storage plants with storage basins requiring 200 to 400 hours to fill; and seasonal plants with reservoirs requiring over 400 hours to fill. In most of the last type water is stored during periods of high water and used in turbines at low water to provide power for distant centres. Reservoir capacity is small in comparison with consumption requirements.

Transfers of power between various parts of Europe are due to lack of correlation between production and consumption characteristics and between seasonal variations in consumption and hydro production. Exports from generating countries now account for only 1·3 per cent of total production; this compares with 4·5 per cent as between States in the U.S.A., which is regarded as indicative of the fairly narrow limits for transfers generally.

Capacity and Demand

Usually loads are highest in December and January when the discharge of rivers is lowest, particularly when fed by glaciers. These constitute natural reservoirs which cannot be used in winter, but increase the river flow on melting in the spring when the load is falling off. Consequently in winter production tends to be low in run-of-stream and daily or weekly storage plants and high in reservoir-storage and thermal plants. Thus in France, where the northern half accounted in 1950 for 56 per cent of the consumption, 8 per cent of the hydro production and 89 per cent of the thermal production of the whole country, the network transfers power at full capacity from south to north at high water periods and from north to south in winter, except sometimes during peak periods, when the movement may be reversed because all seasonal storage plants are in the south.

Loss of water may occur through the potential production of electricity by (base load) run-of-stream plants being in excess of consumers' needs or to inadequacy of transmission networks or to overflows from storage. In Switzerland 847 MW of electric boilers have been installed to absorb surplus power at night. Overflows, amounting to 1·2 per cent of production (1950), are not regarded as justifying the erection of transmission lines for their better utilization —a view that applies also to differences between diversity in consumers' demands.



Power resources and high voltage transmission lines in Western Europe

Frontier transfers are classified as guaranteed supplies, guaranteed exchanges and unforeseeable supplies—all subject to legislation. Only one case is known of transfer over an intermediate country to another by a specially constructed line, i.e., from Laufenburg, Switzerland, to Mulhouse, France, via Germany—which transmits 150 million kWh per annum at 150 kV.

Examples of guaranteed supplies are the export by Austria of part of the Tyrol and Vorarlberg production to Germany, which returns some to Vienna. Swiss companies send up to 60 MW to France and receive 120 million kWh from an Italian company. Poland transmits at 220 kV half the output of Oswiecm thermal power station to Czechoslovakia. Power is sometimes exchanged for electrical equipment as by Electricité de France to Switzerland and Italy and by Yugoslavia to Austria.

Switzerland has barter agreements with France and Germany for the exchange of hydro-electricity for a proportion of the coal thereby saved.

Surplus power is purchased by Electricité de France from five Swiss companies (up to 40 MW, 181 million kWh in 1950) and from one Italian company (up to 25 MW, 1·7 million kWh off peak in 1949). France also delivers 10 MW to a Belgian company and 40 MW (6 million kWh in 1950) to Germany for pumping on the Schluchsee. Italy supplies power to Belgium by relaying through Swiss and German networks.

Guaranteed exchanges have been arranged between Electricité de France and the Belgian Society for Co-ordination of Production and Transmission (C.P.T.E.). The latter supplies 15 to 20 MW to France between 6 a.m. and 10 p.m. during the winter, which is returned to the French authority between 6 a.m. and 8 p.m. in the summer; relationships between winter and summer power are weighted. In reciprocal arrangements between France and Switzerland, these seasonal export and import directions are reversed. France also supplies 12 million kWh to a Spanish company during three summer months and receives it back during three winter months. Numerous arrangements, formal or verbal, exist for mutual assistance in emergency.

There are practically no guaranteed supplies of any size which stem from disequilibrium between areas with surplus and with inadequate resources and none in which a stoppage would seriously threaten the economy of a country. Except for the Sweden-Denmark link there are few exchanges between Scandinavian countries, but those between the Benelux countries, France, Germany, Switzerland and Italy, are important.

Cost of Transmission

The cost of transmitting power for 600 miles (including losses) is calculated as roughly equal to half the cost of producing power by a modern thermal power station (including fuel and operation). If all countries in Europe were ideally interconnected, in 22 years' time (assuming consumption doubles every ten years and the present ratio of hydro to total production is maintained) no water resources would be left unharnessed. There are only a few cases where hydro potentialities are well above the average for Europe and the population is below it. Central and south Norway is exceptional and its surplus power could be exported on a large scale to Sweden and Denmark. Other regions possibly capable of exporting lie in the south east of Europe, where abundant water, natural gas, petroleum, lignite and coal are found. Bulgaria and Rumania were recently connected by a line across the Danube which is used to supply Bucharest with electricity generated at the river Maritsa. Barely 1 per cent of Rumania's hydro-electric potential has been harnessed so far. In Yugoslavia, the Dinaric Alps have the highest rainfall in Europe, which presents prima facie justification for the construction of a high voltage transmission system for the export of power, chiefly to Italy and Austria. In addition there are large reserves of brown coal.

Fuel Supplies

Thermal plants in Europe already consume nearly one-fifth of the total annual consumption of solid fuels, which it is believed could be maintained at its present level for about 1,000 years. This applies particularly to the chief coal-producing regions, Poland, Western Germany and the United Kingdom, and also to Spain, Bohemia-Moravia and Slovenia. Western and south-eastern Poland are most favourably placed as regards future electric power productions.

The ultimate volume of power internationally exchanged, involving only marginal production, is unlikely to be great and generally will necessitate the erection by stages of only a limited number of new lines to extend the existing interconnected system but not to be superimposed upon it.

The reports include a wealth of tabulated statistics and details of existing transmission systems in the different countries. They also give particulars in each case of national legislation governing the import and export of power.

Lighting Lectures

TWO programmes of three lighting lectures each have been arranged by the Lighting Service Bureau to be held at the South Wales Institute of Engineers, Park Place, Cardiff (15th, 22nd and 29th October), and at Mackworth Hotel, Swansea (16th, 23rd and 30th October). The subjects are festive outdoor lighting, mines lighting and built-in lighting. Applications for reservations should be made to the Bureau at 2, Savoy Hill, London, W.C.2.

Commercial Motor Show

Electric Vehicles to Meet Special Requirements

APART from new types of battery electric vehicles and trolley-buses the Commercial Motor Show which is being held at Earls Court, London, until to-morrow (Saturday) includes among its display of nearly 450 vehicles petrol models with elaborate electrical arrangements to meet particular needs, and also a considerable amount of new electrically operated equipment for garage use.

Among new battery vehicles, in addition to a 2-ton greengrocery shop, a 1-ton grocery shop and the 3-wheel " Percheron " dairy truck with a payload of 25 cwt, rear wheel drive and a turning circle of 8ft, Smiths Electric Vehicles, Ltd., are showing the new NCB electric " Commuter," one model having open sides and rear for dairy work, and the second being completely enclosed and thus suitable for bakery, parcels and laundry services. The " Commuter " has been designed for easy accessibility, with a walk-through cab and body.

The " Endeavour " is a new " Helecs " 30 cwt battery vehicle brought out by Hindle, Smart & Co., Ltd., for delivery of heavy local loads and is particularly suited to act as a feeder vehicle in congested areas for small electric vehicles. Trojan, Ltd., offer the " Electrojan " battery van as an alternative to its 15 cwt petrol vehicle.

Trolley-bus Exhibits

Five examples of trolley-buses and chassis, all of the two axle type, can be seen on the Sunbeam Trolleybus Co.'s stand. The MF2R overseas chassis with a rear mounted traction motor (B.T.H.) is designed for single deck bodies seating up to forty-four passengers. An F41A chassis with English Electric equipment for Glasgow Corporation is shown alone and with a 62-seater double deck body, and there is an F4 model with B.T.H. electrical equipment and a 60-seater body. Forming one of a further separate order for Derby Corporation the MF2B overseas chassis type has been modified with a wheelbase of 15ft 6in to come within the Ministry of Transport Regulations for a double deck vehicle with an overall length not exceeding 27ft. The body has separate entrance and exit doors and a double staircase to the upper saloon.

A demonstration trolley-bus cab control unit (Metrovick) is a centre of interest on the British United Traction stand where can also be seen a two axle chassis with English Electric equipment for transit type single deck body and a three axle chassis with G.E.C. equipment.

Among specially equipped petrol vehicles are a Land Rover with a Lincoln arc welding plant and a Normand workshop body complete with 10 kVA 230 V alternator set driven by a diesel engine, lathe, bench grinder, compressor, drills, special lighting fittings and 100ft of cable.

Electrical Accessories

New items among components include a fog lamp and other lighting equipment (Joseph Lucas (Electrical), Ltd.), new unbreakable and shockproof rubber tail lights (Flexible Lamps, Ltd.), the " Nobby " time switch (William Clark (Spare Parts), Ltd.), an electrical automatic gear control (Self-Changing Gears, Ltd.), and fan heaters (Weathershields, Ltd.), an electro-hydraulic bus door operating gear for one man operation and a shuttered dual beam lamp to provide each bus or coach passenger with an independent reading lamp (both Wilmot-Breeden, Ltd.). With a new bus direction indicator and a wind tone horn on the C.A.V. stand are switchboards, dynamos, starters, door operating gear, windscreen wipers, driving lamps and batteries. Among a wide range of lamps shown by Marchal Distributors, Ltd., is a flush fitting headlamp with special facilities for accurate beam alignment.

Batteries are very well represented. All Young armoured plate commercial units now incorporate a new envelope assembly using woven glass fibre sheet with natural or synthetic resin. One range of the Oldham " Demi-Armoured " batteries, the oblique filler type, features a new

visual electrolyte level indicator. The internal construction of the Peto and Radford " Shednaught " battery is demonstrated by a sectional cell, while " Exide-Ironclad " batteries are on view in alternative assemblies. Nife nickel cadmium alkaline traction batteries are accompanied by portable floodlights, chargers and a variety of handlamps and cap lamps for general garage and industrial use.

In the transport service equipment section the new Crypton B.300 engine analyser retains the technical advantages of the B.100 unit but is much smaller and considerably lower in price. Various individual portable test sets are also exhibited, as well as the new B.40 " Hydrolek " battery tester, a new range of bench mounting metal rectifier battery chargers, two new home chargers, electrical test benches and service instruments.

All the new additions made to the extensive range of electric tools since the last exhibition are included in the Wolf display. Other new items are Partridge, Wilson & Co.'s " Davenset " dual purpose battery charger which will charge at the normal as well as the rapid rate; the Triangle self-contained hand spot welder which produces 500 spot welds at the cost of one penny; the C.L. Equipments " Auto-Lab " electric testing equipment; the G.S.L. Products " Standard Startall " mains operated mobile engine starter; the Bristol Pneumatic Tools two-stage air compressor and the Joseph Bradbury & Sons 5-ton four-post commercial lift.

Board of Trade Directory

THE *Board of Trade Journal* recently published as a supplement a " Board of Trade Directory." The Board has from time to time received requests for a guide to the functions of its various sections, to assist businessmen in their dealings with the Department. The present Directory is intended to provide all the information of this kind which will not rapidly become out of date. A complete list of the various sections of the Board is included, with their functions, addresses, and telephone numbers; there is a comprehensive alphabetical index of " subjects," giving the sections responsible for each; and there is a detailed list of the various industries for which the Board of Trade, the Ministry of Supply, and other Ministries, are the " Production Departments " (i.e., for which they have primary responsibility in such matters as allocation of materials). The Directory, containing much hitherto unpublished material, should prove of considerable assistance to all who have frequent dealings with Government Departments on commercial matters. Copies may be obtained from H.M. Stationery Office, P.O. Box 569, London, S.E.1, price 9d (10½d including postage).

Road Passenger Transport

ELECTRIC road passenger transport systems are particularly suited to short distance, high density traffic work and in this field long term planning is essential. In a 19-page booklet which has recently been issued by the British Electrical Development Association, 2, Savoy Hill, London, W.C.2, the advantages of electric road passenger transport are related to urban requirements in regard to general traffic problems in new and existing centres of population. It deals first with carrying capacity, traffic flow and safety of the public. The following sections are concerned with acceleration and braking, reserved tracks, shallow subways, health and cleanliness factors through the avoidance of exhaust fumes and carbon particles, and the maintenance of service in foggy and icy conditions. The booklet concludes with a discussion on the provision of adequate stopping places, indirect benefit to local finances, and the strategic and economic benefits through the nation being less dependent upon imported oil.

Mechanical Refrigeration

THE Council for Codes of Practice for Buildings has issued in final form CP406 (1952) " Mechanical Refrigeration," which has been drawn up by a committee convened on behalf of the Council by the Institution of Mechanical Engineers. The Code opens with notes on specifications and testing of plant, while the parts that follow deal with safety and thermal insulation.

Safety is considered from the aspects of life, health and property and recommendations are made for ensuring adequate strength and protection against excessive pressures. Advice is also given on the provision of devices to secure protection against damage arising from low evaporating temperatures and from freezing from cooling liquid. Other aspects dealt with are the safety of electrical installations, alarm signals, choice and storage of refrigerants, and precautions against fire and accident. This includes a table of minimum test-pressures, at works, for various components of the plant, and there are recommendations for minimum test-pressures for the complete system after erection on site. The physical, toxic and explosive properties of the more common refrigerants are set out in an appendix.

The final part of the Code deals with the design, construction, installation and testing and inspection of insulation to assist in maintaining temperatures below the ambient temperature.

Commerce and Industry

Electricity Workers' Pay Increase

Metal Controls Relaxed

UNDER an Industrial Court award announced last week, about 120,000 manual workers employed by the British Electricity Authority and Electricity Boards have been awarded a wage increase of 2d an hour retrospective to the first pay day after 1st August.

Engineering Wages

Representatives of the engineering employers and of the Confederation of Shipbuilding and Engineering Unions were to meet at the Ministry of Labour yesterday (Thursday). A similar meeting will be held later with representatives of the unions and the shipbuilding employers. The unions had intimated earlier that unless negotiations were resumed a ban on overtime would be imposed and piece-work in the engineering, shipbuilding and ship-repairing industries would be restricted. The Confederation had informed Sir Robert Gould, chief industrial commissioner to the Ministry, that they did not press for their original claims for a general pay increase of £2 a week, but were prepared to negotiate with employers about wages generally.

Lighting Demonstration Room

The Holophane demonstration room at Elverton Street, Vincent Square, Westminster, closed for redecorating, is again available to engineers and architects who wish to demonstrate to their clients the basic principles of lighting, particularly related to the Holophane system. It will be recalled that this demonstration room was opened in 1949, and since that date some hundreds of lighting engineers, architects, civil engineers, contractors and engineers responsible for electrical installations in the lighting field have made constant use of the facilities provided.

The lighting demonstration room of Holophane, Ltd., which has now been re-opened

A.S.E.E. Exhibition

As we have already reported, the Association of Supervising Electrical Engineers has decided to arrange a second "Electrical Engineers' Exhibition" next year. It is to be held at Earls Court (West Brompton Hall), London, from 25th to 28th March. Space totalling 57,000 sq ft is available and we are informed that about 70 manufacturing and other concerns have already agreed to participate.

Small Companies and Taxation

Five steps to relieve hardships suffered by small private companies are recommended in a report issued by the Institute of Directors. The report, which has been prepared by a committee under the chairmanship of the Rt. Hon. William Mabane, has been the basis of the Institute's representations to the Royal Commission on Taxation of Profits and Income and to the Chancellor of the Exchequer. It recommends that direct taxation on private companies should be on a scale related to the amount of profits rising from 50 per cent on profits of £12,000 to the full scale where the profits are £25,000 or more; that the limit of deductible remuneration in respect of directors of director-controlled companies subject to limitation,

should be raised to £10,000 or 25 per cent of the profits with a limit of £5,000 in the case of any one director, the salaries of part-time executive directors to be allowed to be included in this figure; that subject to satisfactory safeguards the basis of valuation of the shares of the deceased director shareholder should not exceed the normal Stock Exchange valuation and that there should be the right of appeal to a tribunal; that the arbitrary limit of five years in the case of gifts *inter vivos* should be subject to gradation; and that all executive directors of private limited companies, whether full-time or part-time, should be allowed to participate for taxation purposes in pension schemes arranged by their companies. Copies of the report (1s post free) can be obtained from the Institute, 51, Palace Street, London, S.W.1.

"Better Living" Exhibition

During next week visitors to the Central Hall, Hoylake, will be able to see a new travelling exhibition of modern domestic appliances and television receivers. This is the first of a series of exhibitions. It is hoped that the exhibition will tour centres throughout the country next year and will include Liverpool and Leicester before the end of 1952. The English Electric Co., Ltd., is sponsoring and organizing the exhibition on behalf of its authorized dealers and distributors in the area. Attractive display units have been designed, depicting a modern kitchen and living room, and there are single stands on which refrigerators, cookers, washing machines and television receivers will be shown. A long counter holds a battery of food mixers which visitors will be able to try out for themselves. In the kitchen, talks and demonstrations on food preparation, cookery and home laundry will be given daily throughout the week, while in the living room television will be demonstrated. Each day during the exhibition a food mixer will be awarded to a lucky visitor, and on 11th October, there will be a prize-giving ceremony for all winners. Throughout the week a Marconi television camera will televise visitors to the Central Hall, who will be able to see themselves and their friends on the monitoring screens at various points in the hall.

The central display unit showing a modern kitchen which forms part of the English Electric "Better Living" Exhibition

Aircraft Ground Power Units

An agreement has been made between Crompton Parkinson, Ltd., and Auto Diesels, Ltd., to engage jointly in the production of mobile dual-voltage ground power units of outputs up to 95 kW for starting any class of commercial or service aircraft. These units are designed to give from the one generator either 850 A at 112 V for 10 sec or 1,500 A at 28 V for 10 sec. In addition an auxiliary generator provides for servicing purposes an output of 4·6 kW at 28 V simultaneously with a 112 V starting supply. Units will be available with the generator driven either by a diesel or petrol engine, or by a motor supplied from airfield mains.

Batti-Wallah's Society

The monthly luncheons of the Batti-Wallah's Society were resumed last week, after holiday "recess," and got off to a good start with an address by Mr. J. A. Boyd-Carpenter, M.P. for Kingston-on-Thames, who chose for his subject "Our Economic Position." Much of what he said has been said on other occasions, but the importance of the subject is such that it cannot be too often stated. He dealt with the physical and psychological aspects of the economic situation and referred to such matters as the balance of payments problem, the need for restrictions in public expenditure and credits and also for dispersing the illusion, so prevalent to-day, that things were going to be easy. He spoke of the difficulties of export trade. It was essential that we should balance our expenditure by earnings, and he thought that there should be more flexibility in industry by the building up of newer industries to take the place of those which no longer commanded a profitable export market.

Factory Performance Reports

A new service has been established by the British Institute of Management which provides companies with detailed performance figures of specific American plants in the same industry. This service, which was originally offered as one of the items of the Harriman programme, arose out of the Institute's discussions with firms at home and with American authorities.

The reports give information regarding the plant and product characteristics of the

American firms providing the data, including man-hours per unit of product in each stage of manufacture, sequence of operations, material and product work flow, production practices, material handling, shop layout, standardization, inspection, production control, etc. They are well illustrated with numerous photographs of machines and layout, organization charts, flow charts, etc.

Several reports prepared by the Bureau of Labor Statistics in Washington and made available through the Mutual Security Agency, are ready for distribution. They include reports on fluorescent lighting fixtures and radio and television. Copies (price £1 each) can be obtained from the Institute at 8, Hill Street, London, W.1.

Large Sewerage Scheme

In our article on the Colne Valley Sewerage Board's Maple Lodge Works on 19th September, page 581, we inadvertently referred to Lancashire Dynamo & Crypto "Klosd" motors. Actually the motors are of the "Fankuld" type, "Klosd" being the registered trade name of Crompton Parkinson, Ltd.

Swann Diploma Examinations

The Swann Diploma examinations will be held by the Association of Supervising Electrical Engineers at centres on 20th and 21st May, 1953. The subjects will be electrical installation practice and electrical maintenance. Application forms and copies of regulations and syllabus may be obtained from the general secretary of the Association, 54, Station Road, New Barnet, Herts. The latest date for receipt of application forms is 2nd March, 1953.

Changes of Address

The London Division, Group III, of the British Electricity Authority has moved to Generation House, Great Portland Street, London, W.1.

The Purchase Tax Section of the Secretaries' Office, H.M. Customs and Excise, has moved to King's Beam House, Mark Lane, London, E.C.3. The telephone number (Mansion House 1515) is unchanged.

Visit to Pumping Station

About 40 men from the Bushbury Engineering Works of the Electric Construction Co., Ltd., recently made a tour of the Frankley Pumping Station, Northfield, Birmingham, by permission of the chief engineer, City Water Department, Mr. C. R. Risbridger. The party was conducted round the station by Mr. M. E. Crowther, the mechanical engineer, and his assistant, Mr. Humphrey. The men were representatives from the various departments of the Bushbury works responsible for the manufacture of the electrical equipment for this station, comprising h.v. and l.v. switchgear, power transformers, vertical spindle pump motors, automatic motor control switchboard and mercury-arc rectifiers for ancillary d.c. services.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £157 0s 0d
COPPER, H.C. Electro	ton £285 0s 0d
Fire Refined 99·70 per cent ..	ton £282 10s 0d
Fire Refined 99·50 per cent ..	ton £274 0s 0d
COPPER Tubes	lb 2s 8½d
Sheet	ton £339 0s 0d
H.C. wire and strip	ton £317 15s 0d
LEAD, English	ton £132 10s 0d
Foreign	ton £131 0s 0d
MERCURY	flask £65 0s 0d
TIN	ton £960 0s 0d
ZINC, G.O.B. Foreign	ton £122 0s 0d
Electrolytic	ton £126 0s 0d
BRASS Tubes	lb 2s 3½d
Sheet	lb 2s 6d
Wire	lb 2s 9d
PHOSPHOR BRONZE	
Wire	lb 4s 1½d
RUBBER, No. 1 R.S.S. spot ..	lb 22–22½d

Relaxations in Metal Controls

The Minister of Supply announces further relaxations in metal controls. As from 1st October licences are no longer required for the acquisition and use of the following:—Lead, lead alloys, lead scrap and residues, remelted zinc, zinc alloys, zinc scrap and residues, copper scrap and residues, and copper alloy scrap and residues. Licences will still be required for the acquisition of unwrought copper and virgin zinc, and copper and zinc ores and concentrates. The restrictions on the use of copper and copper alloys in the manufacture of certain articles remain in force.

E.D.A. Public Speaking Competition

The scope of the E.D.A. public speaking competition has been enlarged for the 1953 contest. Hitherto the competition has been confined to the staffs of Electricity Boards, but in future members of the staffs of Generating Divisions and B.E.A. headquarters may enter. The subjects from which competitors can select their speech are:—"Public Relations in Electrical Salesmanship," "Recreation," "The Influence of Electricity on the Coronation Celebrations," and "Gas and Electricity." A booklet giving details of the competition can be obtained from the British Electrical Development Association, 2, Savoy Hill, London, W.C.2. Intending competitors, who must not have attained their thirty-fifth birthday on 31st March, 1953, should note that the closing date for entries is 1st December next.

Trade Announcements

The **British Aluminium Co., Ltd.**, announces the opening of a Southampton branch office to handle sales of unwrought and fabricated aluminium and aluminium alloy in the counties of Sussex and Hampshire. Mr. W. H. Marston has been appointed area representative, and the address of the new branch is 20, Brunswick Place, Southampton (telephone : Southampton 76780).

A new branch will be opened on Monday next by **G. D. Harrison & Sons, Ltd.**, wholesale electrical distributors, of Huddersfield, at 8, Portland Street, off Northgate, Halifax (telephone : Halifax 62218).

A new office has been opened by **Copperad, Ltd.**, at 1-7, Corporation Street, Birmingham, 4 (telephone : Midland 1553), under the managership of Mr. F. Chesney.

Mr. L. W. York, of 71, Avenue Road, Kings Heath, Birmingham, 14, has been appointed by **FitzGibbon & Murray, Ltd.**, as sole agent for the counties of Stafford, Warwickshire, Worcester and Salop.

Mr. William Bruce has been appointed by **Opperman Gears, Ltd.**, as sales engineer for London and the Home Counties.

A. J. Coleman & Co., Ltd., electrical and radio factors, Northampton, have just completed extensions. In addition to Nos. 37/46, The Arcade, they have taken 45 and 51, with the rooms above, enabling them to open a suite of offices upstairs and roomy showrooms on the ground floor displaying a very fine range of fittings, fires, clocks, radio and television. There is now a separate showroom for cookers and refrigerators, etc.

J. H. Boardley, Ltd., have removed to Unitas House, 24/25, Livery Street, Birmingham, 3.

W. T. Henley's Telegraph Works Co., Ltd., has recently opened a new stores depot at 4, Richmond Ope, Richmond Street, Plymouth (telephone : Plymouth 5759).

The Lamp and Lighting Department (offices and stores) of the **Metropolitan-Vickers Electrical Co., Ltd.**, has removed to 4, Whitworth Street, Manchester, 1. The telephone number is unchanged.

Gerard Wakeham, Ltd., the Scottish representatives of **Chamberlain Industries, Ltd.**, have moved to 1, Clifton Street, Glasgow, C.3.

Consulting Engineers

The Association of Consulting Engineers, 36, Victoria Street, London, S.W.1, has issued a new list of members, corrected to July, 1952. The contents include the names of committee members and officers for 1951–52 and 1952–53, lists of engineering subjects covered by its members, members and firms, non-practising members and a geographical list of firms. Copies can be obtained at 1s each post free (1s 6d to non-members).

New G.E.C. Leicester Premises

Larger and more central premises that will allow more comprehensive stocks to be carried have been acquired by the General Electric Co., Ltd., in Queen's Buildings, Rutland Street, Leicester (telephone: Leicester, Granby 721–5). Besides a trade counter, the new premises will include a showroom. They will be opened on 6th October.

South Western Board's Propaganda

The mobile service centre of the South Western Electricity Board is visiting a number of villages in the Bridgwater district to give a series of washing machine demonstrations. Miss Muriel Delbridge, the demonstrator, will undertake the weekly wash and hopes to do the average wash for about 160 people each day.

The Board's mobile service centre was a feature of the recent Melplash Agricultural Show in the Bridport area.

Works Lighting

In last week's issue (p. 663) we reproduced a photograph illustrating Revo fittings installed by the Consett Iron Co., Ltd. It was stated that "Silverblue" street lighting fittings were used whereas in fact Revo "Silvergold" sodium street lighting fittings have been employed.

Catalogues and Lists

J. H. Sankey & Son, Ltd., Refractories Division, Ilford, Essex.—Illustrated leaflet describing a new range of vitrefied buff tiles suitable for acid-resisting floors, tanks, etc.

Electric Art Shades (1928), Ltd., Ferring Factory, Kelvedon, Essex.—Illustrated priced folders on bed-lights and table lamps.

Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.—Publication GC.853 dealing with capacitors for the radio, television and electronic engineering trades.

Concordia Electric Wire & Cable Co. Ltd., Long Eaton, Nr. Nottingham.—Technical folder dealing, *inter alia*, with "Polyflux" and "Polybond" enamelled copper wires (Pub. 452).

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—56-page priced booklet on "Osram" lamps and tubes (Part 1), and booklet dealing with electrical equipment for use in aircraft.

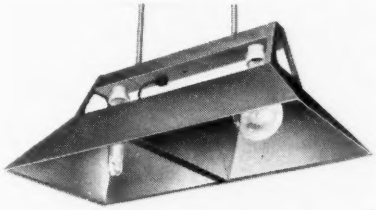
Thorn Electrical Industries, Ltd., 105-109, Judd Street, London, W.C.1.—A folder dealing with "Atlas" fluorescent lamps (AL/115).

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Mercury-Tungsten Fitting

A COMBINED mercury and tungsten industrial lighting fitting made by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, gives similar light distribution



G.E.C. mercury and tungsten lighting fitting

from both lamps so that almost perfect colour blending is obtained. Installation is simple, since only the light top channel is fixed to the conduit, the reflector portion complete with choke being hooked on afterwards.

The main housing is of 20 s.w.g. grey stove enamelled sheet steel and the inner reflectors of anodized aluminium. The lampholders are arranged for two fixing positions so that any combination of lamps, 250 or 400 W mercury and 500, 750 or 1,000 W tungsten lamps can be used. The fitting weighs 27·5 lb (44 lb complete with choke).

Switch-fuses and Switch-splitters

A range of " Crown " switch-fuses and switch-splitters which has just been put on the market by BILL SWITCHGEAR, LTD., Aston Lane, Perry Barr, Birmingham, 20, incorporates double pole slow break switches for a.c. operation fitted with interlocks for safety in fuse replacement. The fuses are of the arc-damping type arranged for single pole and neutral, but fuse carriers fitted with h.r.c. cartridge fuses are offered as an alternative and are interchangeable; space for spares is provided.

" Crown " 15 A s.p. and neutral a.c. switch-fuses

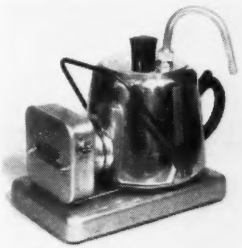
Cables can be taken in at the top, bottom or back and provision is made for earth continuity on the moulded models. The metalclad units are fitted with knockout smooth bore bushes allowing for conduit or rubber cable. In all models cables can be split inside the cover after entry.

Travelling Iron Adaptors

Two plug adaptors which enable the universally applicable H.M.V travelling iron to be connected to the standard American and Continental sockets are now available from H.M.V. HOUSEHOLD APPLIANCES, Hayes, Middlesex. They supplement the bayonet connector and universal two-pin plug supplied as standard with the model and are priced at 6s 6d each.

Tea-Making Apparatus

An automatic electric kettle has been introduced by L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, London, W.C.2, at the price of a normal electric kettle. When the " Tiffee " is switched on it will boil the water, make the tea or coffee, automatically switch itself off and ring an alarm.



The Hawkins " Tiffee "

Occupying a space of only 8in by 5in, it takes up very little room on the bedside table and is so constructed that it cannot be switched on unless filled with water. During the day it is also suitable for use in the kitchen and for afternoon tea. It holds two pints of water and the loading is 750 W. Finished in any of three colours, green, blue or cream, and polished aluminium, it is priced at 75s 0d.

Three-Light Switch

A novel dimming device now available from ELECTROTHERMAL ENGINEERING, LTD., 270, Neville Road, London, E.7, consists of a neat

"Dimma" three-light switch

pear-type switch to which is attached a short length of voltage-dropping resistance cord terminating in a connecting plug. By manipulation of the switch lever it is possible to control the intensity of the light—full on, two-thirds, one-third or out. The "Dimma" three-light switch is made for two ranges, 25–60 W and 75–100 W and is priced at 19s 6d.

Two-Plate Cooker

To meet the demand for a family cooker at a lower price, TRICITY COOKERS, LTD., 109, Kingsway, London, W.C.2, has produced the "Tricity 528." The only respect in which the cooking capacity differs from larger models is that a 6¼in hotplate with a loading of 1,000 W is supplied in place of the more usual 8in type, while the loading of the grill boiler is reduced to 1,800 W. The oven interior measures 12¼in deep by 11½in wide by 10½in high, the loading being 1,150 W.

A master selector switch enables the maximum loading of the cooker (3,950 W) to be reduced to 2,950 W so that the appliance may be installed in a 13 A ring main circuit. This switch, which restricts the use of the cooker to any one or two elements at a time, is an optional fitting without extra charge.

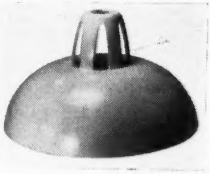
The cooker is built of steel panels mounted on angle frame and has an ivory exterior finish, with black interior. Lagging of the oven is by means of air spaced aluminium reflecting panels and laminated "Fibreglass." The overall dimensions of the model are 19½in wide by 16½in deep by 36in high, and the total weight is 106½ lb. The elements conform to E.D.A. standards of interchangeability and earthing.

The list price with or without the master selector switch is £20 15s 0d.

The "Tricity 528" cooker

Industrial Lampshades

A range of white plastic shades introduced by VOLEX ELECTRICAL PRODUCTS, LTD., Salford, 6, consists of large and small bell, dome and conical patterns, and an 11in "Ventical" shade with separate ventilated gallery. Designed to provide maximum illumination and distribution of light with a minimum of glare, they are of robust construction and it is claimed that they will withstand many years of use without discoloration. The range is comprehensive and suitable for use in offices, factories, hospitals and schools.



VS/100 "Ventical" shade

New Resistance Material

A NEW "super-heat" type of electric resistance material for use in air has been developed by A.B. Kanthal, of Hallstahammar. Withstanding temperatures of between 1,600 deg and 1,700 deg C (about 3,000 deg F) the alloy is expected to be of considerable importance in the design of high-temperature furnaces. The new material, which will be put on the market towards the end of the year, is a powder-metallurgical product built up on the basis of molybdenum. In developing the product at the Kanthal laboratories the manufacturers have had in mind in the first place its utilization for dental and laboratory equipment and for firing ceramic products. It is expected, however, that the alloy will also be suitable for other purposes.

Engineering in Europe

Survey of Current Literature

THE spark set up on the breakdown of an insulating gas column turns into the stable arc discharge when the energy of the external circuit has reached a value sufficient for initiating and maintaining such a discharge. The energy conversion in the spark gap heats up the gas and certain spots on the electrode surfaces, stimulating the production of more charge carriers. Simultaneously the p.d. falls to the much lower value of the arc voltage.

This paper deals in a short introduction with the processes leading to the initiation of a gas discharge, the main section giving the essentials of Toepler's theory of the spark resistance and the relationships derived from it for the transition between sparking and arcing stages in circuits of negligible inductance. More recent theoretical considerations enable the transition between the two stages to be described in an equally satisfactory way, but an experimental decision of the question which of the two theories is really the pertinent one could not be reached so far. "The Transition from the Spark Discharge to the Arc Discharge," by B. Gänger, *A.S.E. Bull.*, Vol. 43, No. 15, pp. 626–633, 26th July, 1952, in German.

Cable Corrosion

The development of d.c. traction intensified corrosion dangers for various kinds of buried structures, power and communication cables as well as water and gas pipes. The main causes of these dangers are electrolytic processes due to stray currents. By the way, to catch the "culprit" in any particular case, i.e. to determine whether the stray currents have leaked from a railway supply line or from a general supply system, is by no means easy and sometimes even impossible.

Many national and international bodies have concerned themselves with the problems of corrosion and, as a result, many systems of protection against, or in mitigation of, these undesirable phenomena have been devised and tried out. One main principle of protection is the passivation of the metal, or setting up of a pH-equilibrium at the metal protected. This is achievable, among other ways, by cathodic protection. Another method is "electrolysis drainage," mainly used on cable lines and, to a lesser extent, on gas pipes.

It is known in the variants of the direct drainage (metallic connection between protected structure and offending rail track or return conductor), polarized drainage (valve element inserted into connections to permit only unidirectional current passage) and current-tapping or forced drainage by the use of a special generator for maintaining the rails at a positive potential with respect to the protected structures. There are, furthermore, the classical cathodic protection with buried anodes (ground-bed anodes, distributed or continuous anodes) and the protection by reactive electrodes (Zn or Mg). All these are briefly discussed in this article.—"Protection of Buried Lines against Electrolytic Corrosion," P. Reynaert, *Bulletin* Ass. Ingenieurs Electriciens Montefiore, Vol. 65, No. 2, pp. 95–112, February, 1952, in French.

Capacitor Insulation

The capacitance of unimpregnated kraft paper increases regularly with temperature, and the heat losses, initially falling to the minimum, increase after having passed through it. At a low temperature the losses increase with frequency, at a high temperature they decrease. There are, furthermore, losses due to ionic impurities, polar losses decreasing with rising temperature, losses by interfacial polarization increasing with temperature and losses by true conductivity (almost negligible). The conditions after impregnation of the paper scroll by an impregnant like pyralene are theoretically satisfactorily represented by an equivalent series circuit (capacitor with composite dielectric).

The effects influencing the capacitance of an impregnated paper capacitor also include a temperature effect related to the impregnant effects of voltage, frequency,

and a barrier effect. The results of an experimental investigation may be summarized as follows: The loss angle is a function of the test voltage. At low voltages the losses are greater than at high voltages, but at the latter the capacitor losses depend only on the specific losses of the paper and on the dielectric constant of the paper fibre and of the impregnant. For an impregnant of so high a dielectric constant as pyralene, low-loss paper of low density should be used (pyralene is chlorinated diphenyl).—" Paper Capacitors with Pyralene Impregnation for A.C. Operation: Factors Influencing Capacitance and Losses," J. Coquillion, *Revue Générale de l'Electricité*, Vol. 61, No. 5, pp. 205–213, May, 1952, in French.

Choice of Conductor Section

The problem of the economic conductor section, reduced to the simplest formula, consists in finding the optimum agreement between the investment costs, *rising*, and the losses, *falling*, with increasing conductor section. There is obviously the " technical " minimum of the cross-section indicating the lower limit of the permissible section and determined by the bearable voltage drop and temperature rise, respectively, and the compatibility of all these factors constitutes the essence of the problem.

The author analyses each of these factors separately and shows that graphical methods can be used for this purpose with great advantage, especially in cases where the relation between erection and operation costs and conductor section has a non-linear character (the most frequent case). Also, the important problem when a replacement of an existing conductor section by a larger one is economically justified is treated in great detail and in several typical numerical examples.

The most important conclusions drawn are: (1) The economic current density is a constant; (2) the same total costs may be incurred at two different values of the current density, one higher (d'') and one lower (d') than the economic density (d_0) and connected by the relation $d'd'' = d^2_0$; (3) the use of sections differing considerably from the economic section S_0 produces only a relatively small increase in the annual transmission costs (e.g., 4·2 per cent for 3/4 or 4/3 S_0; 8·3 per cent for 2/3 or 3/2 S_0). Thus, ultimately, technical considerations will always be more important than economic ones in the choice of the conductor section. " Determination of the Economic Section of Transmission Line Conductors," by A. Beaufay, *Electricité*, Vol. 36, No. 184, pp. 123–130, June, 1952, in French.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

Contact Metals

A very clear and systematic introduction to the science of contact metals outlines their desirable and undesirable characteristics as such and the possibilities of improving these characteristics by alloying. There are also many equally clear diagrams illustrating the text which are mostly self-explanatory. The technological aspect of the problem is treated with equal precision and thoroughness, so that the main part of the paper, devoted to materials obtained by powder metallurgy, is built on sound foundations and follows more or less organically from the comparatively long (but certainly not *too* long) introduction.

This main part illustrates the properties of a selection of materials of American, British, Czech and Austrian production (Asko, Elkonite and Elmet products) mainly by another array of performance diagrams and tables with brief discussions. It should provide a good overall guidance in the selection of a contact material for any special purpose, necessarily only so far as a general direction is concerned, but facilitating the search for the " ideally suited " material. " Recent Developments in Fritted Contact Materials," by A. Vambersky, *Elektrotechnicky Obzor*, Vol. 41, No. 6, pp. 272–278, June, 1952, in Czech.

Signal Modernization

ANOTHER stage of the Southern Region's £2,000,000 scheme to equip the whole of the London to Brighton line with modern colour light signals will be completed this month when the new system is put into operation between Battersea Park and Selhurst. Eleven signal boxes will be abolished and their place taken by three new all-electric boxes situated at Clapham Junction, Balham and Streatham Junction. These three boxes, which between them contain a total of 225 miniature type working levers, and operate 39 automatic sections, will control the whole of the 125 multiple aspect, long range colour light signals between Battersea Park and Selhurst, a distance of 14¾ miles.

ELECTRICITY SUPPLY

Appeal Against River Pollution Decision

Longest Power Line Span

IT is learned that the British Electricity Authority and Derby Corporation are to appeal against the decision in the action brought against them by the Pride of Derby and Derbyshire Angling Association and the Earl of Harrington alleging that they had polluted fishing grounds in the rivers Derwent and Trent. Derby Corporation and the B.E.A. were perpetually restrained from permitting effluent to interfere with the enjoyment of the fishing rights.

Canadian Power Line

Claimed to be the longest of its type in the world, a 170 kV 72,000 kVA power line span has recently been completed at Kootenay Lake, B.C. The distance between towers is 10,656ft, and so far as can be determined, the line is about 3,000ft longer than the longest known span, in Switzerland.

Fabricated and erected by the Dominion Bridge Co., Ltd., Vancouver, for the Consolidated Mining and Smelting Co. of Canada, Ltd., the span is a link in an 87 mile power line between water power plants on the Kootenay River, near Nelson, and mining, concentration and future chemical fertilizer operations at Kimberley, B.C. The lake span is now supplying power to the company's Bluebell Mine at Riondel; the last leg of the line to Kimberley is still under construction.

Installed at the west side of the lake on a hill more than 1,200ft above the water are three towers 50ft high which carry the cables to a single tower 366ft high on the eastern shore. Each 1¼in diameter galvanized steel strand is 10,733ft long and weighs approximately 18 tons. Each strand was pre-stressed and is designed for 55 tons maximum tension.

Progress of Stella Project

Most of the preliminary work has now been completed for the new power stations under construction at Stella North and Stella South,

The Kootenay Lake power lines running from the three towers in the foreground to a single tower on the distant eastern shore

near Newcastle-on-Tyne and the power stations, which are costing £15 million each, are expected to be in operation within three years. Work completed so far includes the laying of railway sidings for 2,800 wagons, the excavation of 100,000 tons of material for foundations and the construction of a fuel store to hold 90,000 tons of coal. Work is now in hand on two 400ft chimneys. Recently plans were approved for two 500ft quays to handle barges which will take away to sea about 600 tons of ash daily.

Protest Against Charge for Supply

The Newcastle-on-Tyne Education Committee has been asked by the North Eastern Electricity Board to make a contribution of £1,945 towards the capital cost of installing electricity at Denton Square Primary School and has decided to protest against the charge. In order that joint action can be taken, the Committee is forwarding to the North Eastern Council of Education Committees particulars of charges imposed by the Electricity Board for supplying electricity to this and other schools.

Cumberland Rural Scheme

The North Western Electricity Board is to supply electricity to the Holme St. Cuthbert area of Cumberland subject to a satisfactory response from prospective consumers, including 58 farms. The work will cost over £30,000 and will take three years to carry out.

Assisted Payment of Accounts

The North Western Electricity Board is now operating in the Buxton district a scheme to help consumers to meet their quarterly accounts. Consumers may obtain a stamp valued at 2s 6d from their local electricity centres, so that small payments may be made in advance to meet hire-purchase instalments, simple hire charges, and quarterly bills. The stamp may not be used for paying installation work accounts or for cash or credit purchases.

Pakistan Hydro-Electric Schemes

It is understood that Canada is considering giving assistance to Pakistan under the Colombo Plan in the proposed hydro-electric schemes at Mianwali, Warsak and possibly Karnaphuli. Two Canadian experts are to go to Pakistan and to report to their Government on the type of assistance that can be given.

Development in Ireland

A new £20,000,000 loan, which is to be issued at par with 5 per cent interest, is to be devoted to major capital projects in Ireland, such as the expansion of electricity undertakings and the development of peat resources. Referring to turf-burning power stations, Mr. McEntee, Minister of Finance, said that the pioneer station at Portarlington generated 130 million kWh during 1951–52. The average output from the Erne project, when it had been fully developed, would be 215 million kWh.

The Electricity Supply Board, in conjunction with the Bord na Mona (Turf Board), has selected a site of about 50 acres for the third turf fired generating station at Lumcloon, Banagher. Work will begin at once and the station will take at least three years to build.

House Installations

Wood Green Housing Committee has agreed that a control panel for an electric cooker and a plug point for a heater shall be installed in all flats and houses to be erected by the Council on various housing sites in the future.

STREET LIGHTING NOTES

A SCHEME estimated to cost £59,200 for improved street lighting in streets at BLACKPOOL where the existing lighting is considered inadequate was recently submitted to the Ministry of Transport for approval. The Ministry, however, has indicated that at present it is prepared to approve only a portion of the scheme, for work estimated to cost £12,000, and the Committee has now approved the carrying out of this part.

CANNOCK Rural District Council is to ask the Minister of Transport to increase grants towards the cost of modern lighting installed by parish councils on trunk roads, as some parishes find the cost of Class " A " lighting beyond their means.

ASHBY-DE-LA-ZOUCH'S new street lamps, which have cost the Urban District Council £4,500, were switched on for the first time on 8th September.

A system of sodium electric-discharge lighting was recently switched on in Ashfield Road, ANDOVER, which thus became the first road in the town to be electrically lit. Similar lighting is to be provided on part of the Mead Hedges housing estate.

GOOLE Corporation has approved a scheme estimated to cost £2,479 for the lighting of Victoria Street, Hook Road and Swinefleet Road by electricity.

The Ministry of Transport has approved a scheme for the improvement of the street lighting in High Street, ELSTREE.

FELLING (Co. Durham) U.D.C. has instructed the surveyor (Mr. H. Fawcett) to prepare a scheme for replacing gas lighting by electricity on the roads approaching Victoria Square, Felling.

NEWCASTLE-ON-TYNE City Council has approved the erection of 32 electric street lamps on section " B " of the Fairways estate at a cost of £944.

Trunk road lighting at a cost of £11,900 is to be provided on the Great North Road between the DONCASTER borough boundary and Green Lane, Scawthorpe.

Typical assembly line at the Doncaster factory of Crompton Parkinson, Ltd.

FRACTIONAL H.P. MOTORS

Modern Methods of Large-Scale High Quality Production

SOME manufacturers have been wise enough to build their organizations and reputations on quality but not all of these have found it possible to increase quality and output per man-hour simultaneously. The new Crompton Parkinson factory at Doncaster specializing in the production of fractional h.p. motors provides an interesting example of how this can be done. The degree of application varies in different parts of the factory with the quantity of the types being handled. Some sections are completely mechanized while in others skill and craftsmanship are the predominant factors.

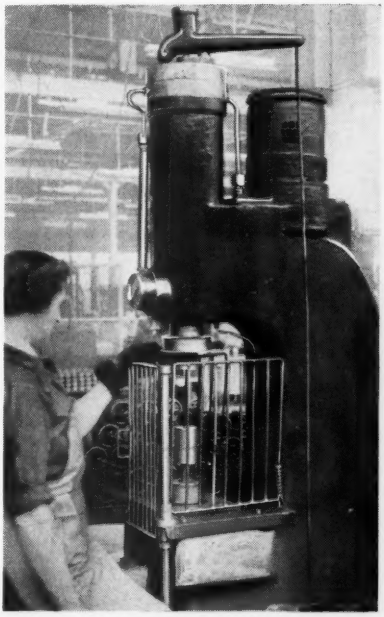
Manufacture of fractional h.p. motors was first started by the company at its Chelmsford Works in 1932. During the war years the department produced large quantities of generators for aircraft and alternators for anti-aircraft gun equipment, but after the war, faced with a shortage of suitable labour in the area, the company decided in 1949 to transfer the department to Doncaster.

In order to ensure that manufacturing methods in the new factory were at least equal to those employed in America, the company in 1946 sent its own productivity team to visit a large number of factories in the United States and Canada.

Increased mechanization has emphasized three points: First, the necessity for designing the product not only for the job it has to do, but to fit in with the manufacturing facilities which are to be used; secondly, the need for breaking down and simplifying the processes; and thirdly the desirability of the greater use of mechanical aids to speed up operations and reduce human errors.

Greater mechanization has not only

Pressing the shaft into the rotor



resulted in increased output at reduced cost, but it has also appreciably increased quality, by demanding better material and components and giving a greater degree of accuracy in the finished component. The result of these improvements has been that output has been increased threefold with constant improvement in quality and reduction in labour costs.

The machines manufactured range from $\frac{1}{8}$ h.p. to $1\frac{1}{2}$ h.p. at various voltages and speeds. Types include split-phase, capacitor, repulsion-induction, d.c. and three-phase squirrel cage. They may be either drip-proof or totally enclosed, fitted with either sleeve or ball bearings, and various types of mounting are available.

It was decided to split production into a number of separate plants each designed to handle best its own particular range. One plant is designed specifically for the efficient production of large quantities of motors for washing machines and refrigerators, another for wound armature and rotor types, and a third for mixed types. The greatest degree of mechanization has obviously been achieved in the section making washing machine and refrigerator motors.

The layout was designed so that all machining is at one end of the factory and the cleaner operations such as winding and assembly at the other. Raw materials for shafts, rotors, stators and endshields enter at one end of the factory and after machining and inspection are transported either to winding and assembly or to stores. Winding wires, switches, terminals, etc., are issued simultaneously to the winding and assembly sections.

Shafts for washing machine and refrigerator motors are turned on a five-spindle bar automatic with a very high production rate and ground on a centreless grinder. The core seating is knurled on a specially designed high production knurling machine. The shaft is then drilled, keywayed, inspected and passed to stores. Where batches are smaller, shafts are parted off and centred, then turned on Carbicut high speed lathes, drilled, keywayed and, after inspection, passed to stores.

Rotors are mainly diecast or welded copper. The former are produced by pressure or displacement depending on the type and the copper rotors are carbon-pil· arc welded. For the copper rotors, bar i: automatically fed into the slots from coil and cut off to length as the rotor cor(indexes round. These ingenious machine: have been designed and made by the company's engineers. After the rotors have been pressed on to shafts, the shafts are trued and the rotors turned on high speed lathes. Open-circuiting gears and a separate fan are fitted when required. On diecast rotors fans are cast integral with the rotor end ring. Each rotor is then very accurately dynamically balanced on one of several electronic machines.

Stator cores are riveted at one operation on a specially designed six-station riveting machine. Steel plate is cut to length and rolled on machines specially designed to produce round shells in a very short time-cycle. Shells are then wrapped round the cores and welded. The welds are ground, the shells dowelled, rough spigoted, drilled and tapped and finally inspected. On the large batch type of stator all holes are drilled and tapped simultaneously on two specially designed machines and after inspection the stators go through to winding or stores.

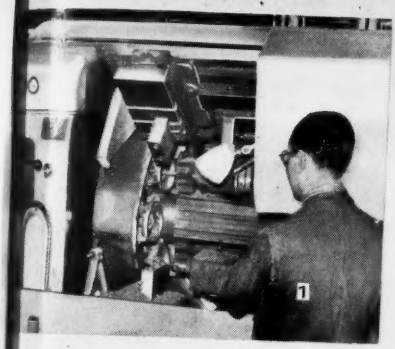
The large batch endshields are turned and bored on six-station Gridley & Ryder automatics. White metal bearing bushes are inserted and the endshields are drilled and tapped on multi-spindle machines. Boring of the bush and final facing and spigoting of the endshield are done at one setting on two-speed fine borers, thus ensuring maximum concentricity.

Coil winding methods vary from the conventional bench type winder, producing single coils, to special four-station machines which enable a girl to tie up and remove one pole while another pole is being wound.

During our recent visit we were also ho wn a most impressive stator winding machine which has been developed and made by the company and which winds all four poles of the running winding simultaneously in much shorter time than is possible by hand. All coils are specially shaped to make the insertion of the coils an easy and simple task.

We were very impressed by the ingenuity displayed in the design and manufacturing of special purpose automatic machine for

On opposite page: **(1) Endshield machining. (2) Dynamic balancing of rotors (3) Armature winding. (4) Welding of copper rotors. (5) Stator winding. (6) Running test. (7) Final test in silence rooms. (8, 9 & 10) Typical special machines for stator coil winding, shaft turning and endshield machining**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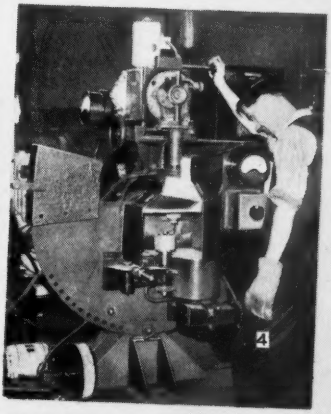
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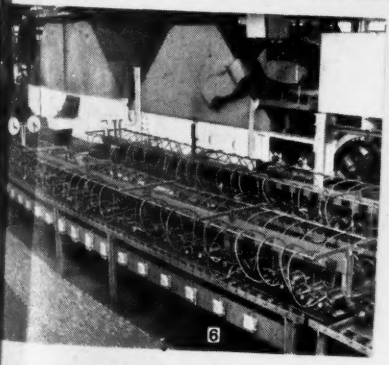
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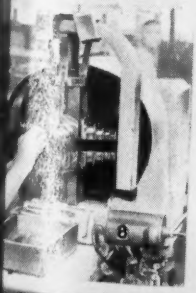
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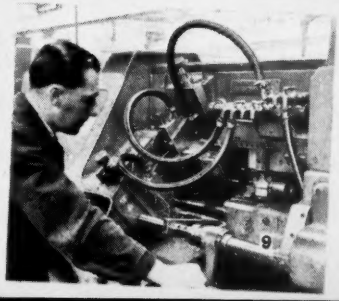
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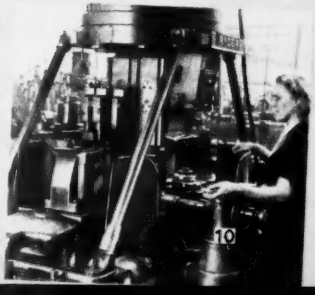
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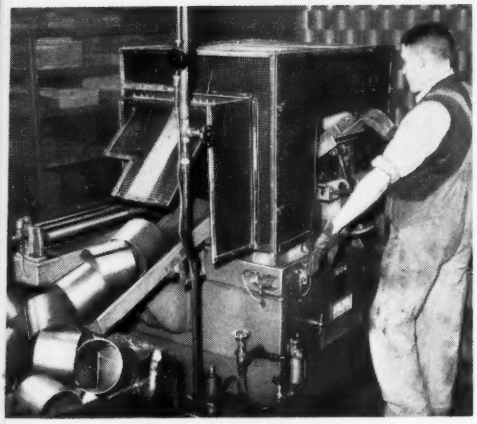


Rolling of shells from lengths of sheet steel

cutting, stripping and eyeletting of leads. Machines have been developed which take slot insulation from spool, cuff and form it and then insert the slot packets into the stator slots. The stator is insulated more uniformly and quickly than is possible manually.

Diecasting of the aluminium rotors

In the winding sections the operations have been broken down and each girl does only a portion of the winding. Stators flow down these lines and at various stages the windings are pressed and shaped on specially designed air presses.

Special attention has been given to the insulation of slots and the insulation between coils and windings. This ensures a very low proportion of rejections and freedom from site troubles.

After insertion of the running and starting windings the ends of the coils are welded and insulated and the end coils are shaped on a specially designed double action air press. The stator windings are subjected to a rigorous visual inspection, and polarity and high voltage tests are applied.

The wound stators are hung on a bar type conveyor and after passing through impregnation varnish, they go into a preheating chamber where surplus varnish drips off and the solvents are driven off before the windings are subjected to the higher temperatures of the stoving oven.

From the impregnation conveyor the stators are put on a lathe in a fixture specially designed to protect the windings and the spigot is skimmed to the final limit. This eliminates the possibility of damage to the spigot during its handling through the works and ensures that any distortion due to the oven temperatures is corrected. The stator is then put on a specially designed short circuit tester incorporating a cathode ray tube and is overstressed at high-frequency to reveal any potential source of weakness.

Stators, rotors and endshields are issued to the final assembly lines, which are arranged on a progressive flow basis and provided with air operated screwdrivers and nut-tighteners. Resilient rings, condensers, "Thermatrips" and terminal bases are fitted as required.

After a preliminary check, the motors are given an extended running-in test before passing into silence rooms where they are subjected to thorough electrical and mechanical tests using specially designed dynamometers. Each motor is checked for no load and full load watts and current, for starting torque, run-up torque and for balance and quiet running, and is given a final high voltage test outside the silence rooms. Special testing facilities are available for the less standard types of motors.

In the finish-off section motors are checked against orders and resilient bases, terminal covers, etc., are fitted. Motors are then finally sprayed, nameplates fitted and connection diagrams and instruction leaflets inserted in the terminal enclosure before the motors pass along conveyors to the packing and despatch sections.

The company has designed and produced a non-spill sleeve bearing, which is filled with free oil before despatch from the works and will, it is claimed, operate for at least two years before any further oil is necessary. This patented "Marathon" bearing ensures positive separate lubrication of the thrust surfaces thereby eliminating the possibility of end-knock developing.

Special attention has been given to the designing and manufacture of an automatic open circuiting device which will give the utmost reliability in service. These centrifugal gears and switches are tested frequently to do up to 1,000,000 stop-starts.

A range of thermal overload switches (the "Thermatrips" already mentioned) of both automatic and hand reset types is available. These operate both on current and temperature and give full protection to the motor against damage due to overload or low voltage conditions.

Fluorescent Mine Lighting

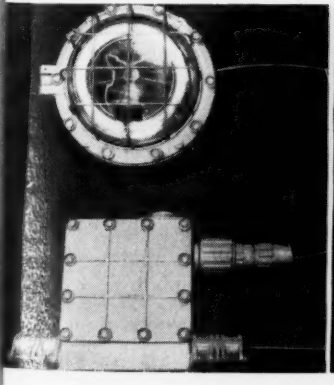
SPEAKING at a recent function at Sunderland in connection with the centenary celebrations of the North of England Institute of Mining and Mechanical Engineers, Professor Granville Poole, president, referred to a new type of fluorescent lighting fitting now being used in several collieries in Northumberland. He said that the lamp was designed in the Mining Department of King's College, Newcastle-on-Tyne, by Mr. W. B. Bell, lecturer in mining, and Mr. K. H. Brown, post-graduate research worker, under the supervision of Mr. E. L. J. Potts, head of the Mining Department. The designers of the new lamp worked in conjunction with Clarke, Chapman & Co., Ltd., who are manufacturing it and have sent us particulars.

While fluorescent lighting in mines is not new, the introduction of a circular lamp has made it possible to introduce a compact, lightweight, flameproof unit 15in in diameter and 7in deep weighing 40 lb. The lamp is rated at 40 W and is mounted by quick-release fasteners on shock-absorbing pillars to a specially-designed anodized reflector giving good, wide light distribution. The casing is of cast aluminium alloy and the fitting has an "Armourlight" domed glass front protected by a wire guard. A junction box developed for use with the fitting is of cast aluminium alloy and houses the "Transtar" (instantaneous start) control gear, safety switch and starting switch.

The wander-lead system is employed for the fitting. The main cable is run along the coal face between the conveyor and goaf side supports. Junction boxes placed along the cable are each fitted with a socket for connection to the wander-lead on the lamp fitting, enabling the lamp to be placed in the most suitable position.

Each unit is independent and damage to one will not affect others. The safety switch automatically cuts off the supply if the lamp is damaged and when the plug is withdrawn.

The "Dunelm" mine lighting unit and junction box with *(right)* one of the fittings in use at the coal face (Ellington Colliery, Northumberland)



FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

The General Electric Co., Ltd.—The effects which higher labour rates and increased taxation are having upon industry were dealt with by Sir Harry Railing (chairman and joint managing director) in his speech at the annual meeting of the company, held on 25th September. Sir Harry said that they had achieved a further moderate increase in net profit. This result was due to an increase both in volume and value of their turnover, and the majority of their establishments had contributed to this new record in spite of the difficulty of obtaining skilled labour and raw materials.

Referring to profits and taxation the chairman said that their turnover had increased during the year by £7,000,000, and a corresponding rise in wages and salaries amounted to £2,900,000. The result of their activities was an increase in gross profit of £950,000 and an increase in the net profit of only £113,000, or less than 2 per cent on the increase in turnover. With the present taxation, 67 per cent of the profits went to the nation, and the manufacturing industry provided the Exchequer with £500 million. Unless industry was enabled to plough back sufficient margins or to attract sufficient new capital, it would neither be able to provide the tools nor wages, nor maintain exports. Industry must be allowed to earn, and after taxation, to retain sufficient capital. Without a sufficiency of industrial capital our assets of man-power, plant, minerals and gold reserves were wasted, and the increased production could not be attained.

The word "profit" had become meaningless when it left out of consideration replacement of stocks and plant at present costs and many similar factors. The general misuse of the word was the fundamental reason why fantastic wage claims were put forward, as, for instance, the one of the A.E.U. which asked that the engineering industry should "out of profits" provide £2 per man per week, which would amount to some £250 million.

We could not carry on with low average outputs per man per sq ft of floor space and per machine. Unless we got full output from all of them, we should be unable to meet the costs of our competitors. This explained why it had become increasingly impossible to accede to wage demands unless they were linked with greater output. Overseas orders could only be obtained, assuming equal quality, or price or delivery. Any direct or indirect demand, any measure which increased cost price or delivery, automatically handicapped our national economy and reduced our standard of living.

Sir Harry then went on to review some of the company's achievements during the year under review. Their exports from home, as well as their output from factories abroad had also increased. Among notable orders were one for a 62,500 kVA horizontal water wheel alternator for Norway, and a heavy programme for the British Electricity Authority including turbo-alternators, transformers, switchgear and boiler plant electrical equipment. Their switchgear works had developed new 132 kV outdoor circuit breakers of 3,500 MVA breaking capacity for use in connection with B.E.A. and overseas contracts. The year had been an active one in the transport and mining fields. Among outstanding orders received by the Pirelli-General Cable Works was a contract for a 301 kV oil-filled cable from the Aluminum Co. of Canada. In the field of lamp manufacture, Glass Bulbs, Ltd., owned jointly with the British Thomson-Houston Co. Ltd., had completed its first full year of operation, and by the end of the year it had reached a production rate for home and abroad of one million bulbs a day. In research, the main laboratories at Wembley were being enlarged and a fourth extension establishment would be opened shortly. The annual expenditure exceeded £2 million.

Dealing with the outlook Sir Harry said that in face of other large units, like the United States and the U.S.S.R., a Commonwealth plan for co-ordination and ordered development of its resources was overdue. The desirability was beyond argument, and the only question was the degree to which it could be put into effect by farseeing statesmanship.

At subsequent class meetings of the holders of "A," "B" and "C" preference stock, and also at an extraordinary general meeting, the board's capital proposals were approved.

The Electric Furnace Co., Ltd., held its annual meeting on 25th September, Mr. D. F. Campbell (chairman) presiding. In his circulated statement, the chairman said that the Electro-Chemical Engineering Co., Ltd., a wholly owned subsidiary, had converted a debit on its profit and loss account into a credit. Its progress both in regard to home orders and export trade had been highly satisfactory. The subsidiary dealing with resistance furnaces had had a successful year. During the year under review plans were made

to form, at the end of the financial year, a new wholly-owned subsidiary, the EFCO Engineering Co., Ltd., to operate the manufacturing side of the Burton works. The company commenced trading in April last. The heat treatment division at the Burton works had been extended, providing special facilities for induction heating. The company's unfulfilled orders were now higher in value and volume than at any time in its history.

Phœnix Telephone & Electric Holdings, Ltd., reports a consolidated trading profit for the year ended 29th February last of £214,667, as compared with £197,770 for the preceding year. After deducting depreciation, taxation, and other charges, there is a net profit of £44,787 (£39,129). It is proposed to pay an ordinary dividend for the year of 10 per cent (same), and to carry forward £10,895 (against £19,151 brought in).

In his statement Mr. G. F. Shipman (chairman) says that the business of the group continued to expand during the year under review, and the volume of orders in hand, a large proportion of which came from Government Departments, is sufficient to enable full production to be maintained for many months ahead. During the current financial year the whole of the issued share capital of Sewell & Hulton, Ltd., Manchester, cotton polishers, has been acquired.

Stothert & Pitt, Ltd., report a profit for the year to 30th June last, after deducting £207,078 for taxation, of £230,230, as compared with £216,383 for 1950-51. It is proposed to pay a final ordinary dividend of 10 per cent (against 5 per cent, and a bonus of 1¼ per cent), making 15 per cent for the year (against 11¼ per cent).

The British Aluminium Co., Ltd., has declared an unchanged interim ordinary dividend of 4 per cent.

The Telephone & General Trust, Ltd., is paying an interim dividend of 3 per cent (unchanged) on larger capital.

Ericsson Telephones, Ltd., has announced an interim dividend of 5 per cent (same) tax free.

Increases in Capital

Barkers Electric Service, Ltd.—Increased by £10,000, in £1 ordinary shares, beyond the registered capital of £10,000.

Record Electrical Co., Ltd.—Increased by £49,300, in £1 ordinary shares, beyond the registered capital of £30,200.

Electric Construction Co., Ltd.—Increased by £250,000, in £1 ordinary shares, beyond the registered capital of £450,000.

Oldham & Son, Ltd.—Increased by £250,000, in 1s ordinary shares, beyond the registered capital of £500,000.

Liquidations

The Overseas Engineering Co., Ltd., electrical and engineering exporters.—Winding up voluntarily. Joint liquidators, Mr. P. L. Oliver, 5, Cheapside, London, E.C.2, and Mr. D. Morgan, 100, Park Street, London, W.1, appointed 16th September. Particulars of claims by 30th October to Mr. D. Morgan.

Lonsdale (Electric), Ltd.—Meeting of members and creditors on 24th October at 4, Chapel Walks, Manchester, to receive an account of the winding-up by the liquidator.

Alan Yates, Ltd., electrical engineers.—Winding up voluntarily. Liquidator, Mr. J. A. Freeman, of Horsfield & Smith, 8, Manchester Road, Bury, Lancs, appointed 16th September. Particulars of claims to the liquidator by 31st October.

F. V. Turpie, Ltd., radio and electrical dealers.—Winding up voluntarily. Liquidator, Mr. A. Brodie, Moor House, Burslem, Stoke-on-Trent, appointed 18th September.

Berkeley Russell, Ltd., radio and electrical engineers.—Winding up voluntarily. Joint liquidators, Mr. R. S. Howard, 84, Cleethorpe Road, Grimsby, and Mr. R. B. Smith, 3, Alfred Street, Boar Lane, Leeds, 1, appointed 11th September.

Bankruptcies

R. H. Myers, trading as "T. Myers & Son," at 169, Aston Road, Birmingham, 6, gas and electrical engineer.—Last day for receiving proofs for dividend 13th October. Trustee, Mr. R. F. Bendall, 126, Colmore Row, Birmingham, 3.

L. R. Maisey, carrying on business under the style of "R. Maisey," at 50, High Street, Alfreton, Derbyshire, and at 3, Main Road, Jacksdale, Notts, electrical contractor.—First and final dividend of 2s 3d in the £, payable on and after 6th October at the office of the Trustee, 5, Regent Street, Nottingham.

R. G. Eves, 138, Hennicker Gardens, East Ham, London, E.6, electrical engineer, lately carrying on business at the Abbey Restaurant, 28, East Street, Titchfield, Hants.—First and final dividend of 7s 3d in the £, payable on and after 10th October at the Official Receiver's office, 16, Westwood Road, Southampton.

W. D. Newall, 35, Duke Street, Padstow, Cornwall, radio and electrical engineer.—Last day for receiving proofs for dividend 10th October. Trustee, Mr. B. Russell, 25, Market Place, Camelford, Cornwall.

J. Bannister, carrying on business as an electrical contractor at 2, The Wiend, Wigan, Lancs.—First and final dividend of 3s 2d in the £, payable on and after 30th September at the offices of the Trustee, 47, Mosley Street, Manchester.

STOCKS and SHARES

A SHARP break in the prices of gilt-edged stocks put an end to the rising trend which had run through most of the summer, and the slump served to unsettle most other sections of the Stock Exchange. Reaction set in with a suddenness which was surprising in the absence of any obviously new factor to account for it. Anxiety has, however, risen over the industrial wages problem; the gilt-edged market is also concerned particularly with the way in which the Treasury is going to deal with a growing volume of short-term borrowing to meet current Government expenditure. New issue activity is acting as another depressing influence, and the combined effect of these factors was no doubt exaggerated by the evidence of a large speculative position in gilt-edged securities. British Electricity stocks were marked down with the rest. The sympathetic reaction in industrials is reflected, among electrical equipment shares, in falls ranging from 3d to 1s 3d in the majority of the price-changes on the week.

British Electricity Stocks

All four of the British Electricity stocks fall due for repayment at 100 during the 1970's, so that although this prospect is too distant at present to act very effectively as a stabilizing influence on their prices, it helps to protect them against the more violent swings experienced by the " undated " issues like War Loan. Both the 3 per cent stocks, for instance, are quoted now some 17 points below their ultimate redemption value, a fact which cannot fail to exert an influence on their behaviour in the interval. While War Loan has been falling dramatically from 78¾ to 75¾, then recovering to 77⅛, the extent of the net fall in Electricity stocks has been comparatively restricted at about 1½ points. This is sufficiently disconcerting, but the redemption terms are there to reassure the genuine long-term investor in the stocks.

G.E.C. Meeting

General Electric ordinary shares were quoted, from the beginning of this week, ex the 100 per cent share bonus. At 40s, the price for the old shares was the appropriate half of the previous quotation. Among the matters which received Sir Harry Railing's special attention at last week's annual meeting of the company, were the effects of present-day scales of taxation on the ability of industrial companies to finance, from earnings, the efficient maintenance of their equipment, and the way in which events have robbed the word " profits " of its meaning. Taxes, he pointed out, absorbed £4·4 million from the latest " profit " of £6·6 million, and have taken a tota of some £16 million of th company's capital over the past five yea during which £3·2 million has been paid i dividends. An increase of £7 million in tan over last year resulted in an increase of on £113,000 in the net figure. The new shares a 41s are 1s higher than the old, the differen being due to the present freedom from transfe stamp duty of the new.

Telephone Manufacturing New Shares

New 5s ordinary shares offered last month shareholders of the Telephone Manufacturi Co., in the proportion of one new for every tw shares held, are being dealt in at a premiu of about 1s 10½d over the price of 5s 9d at whi they were issued. Having regard to the size the premium, shareholders will do well to no the invitation to apply for " excess " shares n subscribed for by way of rights. These applic tions have to be made by the 7th of this mont which is also the date upon which the call 5s 9d falls due. New shares rank equally wi the old except for the usual 2½ per cent interi dividend expected in a few weeks' time. Th are currently free of transfer stamp to the buye and at the all-in price give a prospective yie of 6⅔ per cent, on the assumption that a tot of 10 per cent will again be paid after th increase in capital.

Sturtevant Engineering

The 5s ordinary shares of the Sturtevan Engineering Co. have been changing hand lately at a price of about 24s 6d, with an interi dividend due shortly in respect of the yea ending in December. Last year's interim wa 5¼ per cent, followed by a one-for-six sha bonus, and a final of 12 per cent, both dividen being tax-free. The total was equivalent t 16½ per cent on the present capital of £345,20 all in ordinary shares. The fact that this sam rate was being paid on only £123,300 capital i the early post-war years (since when the have been other capital bonuses of 100 an 20 per cent) gives some measure of the u interrupted expansion of the business over th period, during which distributions have bee kept to strictly conservative proportions.

Brook Motors

This company's financial year ended i September, and the preliminary results can out last year before the end of Novembe These were the second accounts to be presente after the company was made public in 195 As the result of a record turnover, they showe a net profit of £220,000, equivalent to earning of 78 per cent on the £428,000 ordinary capita on which a 20 per cent dividend was pai . Th interim dividend for the year just ended wa repeated at 5 per cent. Maintenance of th total distribution would mean a return practically 7 per cent on the 10s ordinar shar at their present price of 28s 9d.

ELECTRICAL INVESTMENTS

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price 29th Sept. 1952	Week's Rise or Fall	Est. Yield £ s	Est. Yield d
Gilt-edged and Overseas Stocks						
Brit. Elec. 1968/73	3	3	83½	−1	3 12	0
Brit. Elec. 1974/77	3	3	82	−1	3 12	3
Brit. Elec. 1976/79	3½	3½	89	−1	3 17	9
Brit. Elec. 1974/79	—	4½	98½	−1	4 6	3
Calcutta Elec. ..	6†	6†	21/-	—	5 14	3†
East African Power	7	7	25/-	−6d	5 12	0
Nigerian Elec. ..	10	10	21 3	—	—	
Palestine Elec."A"	5†	Nil	12 6	—	—	
Perak Hydro-Elec.	Nil	Nil	12 9	—	Nil	
Equipment and Manufacturing						
Aberdare Cables (5/-)	20	20	13 6	—	7 8	3
Aerialite (1/-) ..	83½	88½	8 3	—	10 11	2
Aron Elec. Ord. ..	15	15	33 9	—	8 17	9
Assoc. Elec. Ord...	20	20	71 6	—	5 12	0
Automatic Tel. & El.	15	15	56 3	−9d	5 6	9
Babcock & Wilcox	18	18	68 9	−¼	5 4	8
Baldwin, H. J. (2/-)	25	25	4 3	—	11 15	4
Bakelite (10/-) ..	—	—	17 6	−9d	—	
British Aluminium	10	12	43 9	−9d	5 9	7
B.I. Callender's ..	7½	9	32 6	—	5 10	9
British Thermostat (5/-)	30	30	27/-	—	5 11	1
British Vac. Cleaner (5/-)	25	25	13/-	—	9 12	4
Brook Motors (10/-)	20	20	28 9	—	6 19	2
Brush Ord. (5/-) ..	10	10	5 3	—	9 10	6
A. F. Bulgin (1/-) ..	27½	30	2 6	—	12 0	0
Burco (5/-) ..	42½	38¾	20 9	—	9 6	8
Chloride El. Storage	15	15	60/-	—	5 0	0
Cole, E. K. (5/-) ..	25	25*	16/-	−6d	7 16	3
Cossor, A. C. (5/-)	Nil	10	9/-	−3d	5 11	1
Crabtree (10/-) ..	17½	17½	35/-	−9d	5 0	0
Crompton Parkinson Ord. (5/-) ..	11½	11½	9/-	−6d	6 5	0
De La Rue (5/-) ..	50	35*	10/-	—	—	
Decca (1/-)	112½	112½	18/-	−6d	6 5	0
Dewhurst (2/-) ..	35	22½*	4 3	—	—	
Dictagraph Tel.(2/-)	20	20	4 9	—	8 8	6
E.M.I. (10/-) ..	8	12	15 9	—	7 12	3
Electrical Components (5/-) ..	20	20	10/-	—	10 0	0
Elec. Construction	15	15	51 3	+⅛	5 17	0
Enfield Cable Ord.	7½	7½	23 9	—	6 6	4
English Electric ..	15	15	55 6	−1 6	5 8	1
Ericsson Tel. (5/-)	22†	22*†	40/-	−1/-	2 15	0†
Ever Ready (5/-)	35	35	25 6	−9d	6 16	7
Falk Stadelmann	15	15	38/-	+1/-	7 17	10
G.E.C. Ord. ..	17½	22½	40/-	−1 6	5 12	6
General Cables (5/-)	30	30	11 6	—	10 6	10
Greenwood & Batley	15	15	37/-	—	8 2	2
Hackbridge Cable (5/-)	20	20	11 3	—	8 17	10
Hackbridge Hewittic (5/-)	18	20	16/3	—	6 3	0
Hall Tel. Acc.(10/-)	10	10	10/6	—	9 10	6
Hea[illegible] (2/-) ..	12½	12½	4/-	—	6 5	0
He[illegible] (5/-) ..	20	20	17 3	+3d	5 16	0
Hol[illegible]ne (5/-) ..	15	15	10/9	—	—	
Ho[illegible] (5/-) ..	37½	35*	24/-	−6d	7 5	9

Company	Dividend Previous	Dividend Last	Middle Price 29th Sept. 1952	Week's Rise or Fall	Est. Yield £ s	Est. Yield d
Equipment and Manufacturing (continued)						
Intl. Combustion (5/-)	20	25	23 9	—	5 5	3
Johnson & Phillips	15	15	53 3	—	5 12	9
Lancashire Dynamo	22½	12½*	42 6	—	5 17	8
Laurence, Scott (5/-)	12½	15	12 3	—	6 2	6
London Elec. Wire	10	12½	48 3	—	5 3	9
J. Lucas	17½	7½*	33 9	−1/16	4 9	0
Marryat & S. (2/-)	22½	22½	5/-	—	9 0	0
Mather & Platt ..	12½	12½	42/-	+9d	5 19	0
Metal Industries ..	10	15	38 6	−6d	—	
Mid. Elec. Mfg. ..	15	15	56 3	—	5 6	8
Murex	12½	15	54 6	−1 6	5 10	0
Newman Ind. (2/-)	6	10	2/3	—	8 17	10
Oldham & Son (1/-)	30	35	3/-	—	—	
Parnall (Yate) (5/-)	6	6	4 6	+3d	6 13	1
Parsons, C. A. ..	15	10*	52 6	—	—	
Plessey (5/-) ..	20	22½	18 9	—	6 0	0
Pye Deferred (5/-)	18	18	15/-	—	6 0	0
Revo (10/-) ..	27½	27½	39 3	—	7 0	1
Reyrolle	15	10*	47 6	−2/-	—	
Scot. Cable (4/-) ..	30	32	11 3	—	—	
Siemens Ord. ..	10	10	33/-	−1/16	6 1	3
Strand Elec. (5/-)..	17½	17½	8 9	—	10 0	0
Sturtevant (5/-) ..	16½†	17½*†	23 9	−1/-	—	
Switchgear & Cowans (5/-)	22½	22½	13 9	—	8 3	8
Taylor T. (5/-) ..	20	20	20/-	—	5 0	0
T.C.C. (10/-) ..	20	20*	37 6	—	—	
T.C. & M.	10	10	25 6	—	—	
Telephone Mfg. (5/-)	10	10	7 6	−3d	—	
Thorn Elec. (5/-) ..	10	12½	8 6	—	7 7	0
Tube Investments	25	25	55 3	−1 9	—	
Vactric (5/-) ..	Nil	Nil	3 9	—	Nil	
Veritys (5/-) ..	Nil	7½	1 9	—	7 18	0
Walsall Conduits (4/-)	70	70	15/-	—	—	
Ward & Goldstone (5/-)	45	45*	29/-	—	—	
Watford (2/-) ..	25	25	6 3	—	8 0	0
Westinghouse Brake	14	14	51 3	−9d	5 9	2
West, Allen (5/-) ..	12½	15	10 3	—	7 6	4
Trusts, Transport and Communications						
Anglo-Am. Tel.: A Ord.	4½	4½	82½	−3	5 9	0
Ord.	56/3	57/6	55/-	—	5 4	7
Anglo-Portuguese	8	8	20 9	−9d	7 11	3
Brit. Elec. Traction: Def. Ord. ..	22½	25	135	+10	5 15	0
Cable & Wireless: Ord.	6	8	121½	—	6 8	6
4% Loan ..	4	4	95½	—	4 3	9
Calcutta Trams ..	6†	6†	23/-	—	5 4	4†
Cape Elec. Trams	4	5	12 6	—	8 0	0
Marconi Marine ..	7½	10	31 3	—	6 8	0
Oriental Tel. Ord.	16	16	55 9	—	—	
Telephone Props...	8	8	30/-	−1/16	5 6	8
Tele. Rentals (5/-)	10	10	8 6	—	5 17	8

* After capital bonus.
† Dividends are paid free of Income Tax.

NEXT WEEK'S EVENTS

Monday, 6th October

BIRMINGHAM.—Grand Hotel, 6 p.m. I.E.E. South Midland Centre. Chairman's address, by Dr. K. R. Sturley, and annual general meeting and conversazione.

HUDDERSFIELD.—Y.M.C.A., John William Street, 7 p.m. Institution of Works Managers, West Yorkshire Branch. "Effects of Taxation of Business," by F. Parker.

ILFORD.—Angel Hotel, 8 p.m. A.S.E.E. North-East London Branch. Question night.

LEEDS.—The Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "Electrification in the Dales," by Mr. Browell.

LIVERPOOL.—Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey and North Wales Centre. Chairman's address, by W. A. Hatch.

MAIDSTONE.—At the "Wig and Gown," 7.30 p.m. I.E.E. Maidstone District Meeting. "The Development and Design of Electrical Control Gear for Machine Tools," by A. R. H. Thorne.

Tuesday, 7th October

BATH.—Electricity House, The Old Bridge, 7 p.m. I.E.E. Bristol Students' Section. Chairman's address, by K. L. Streeter.

CARDIFF.—At the South Wales Institute of Engineers, Park Place, at 7.15 p.m. Incorporated Plant Engineers, South Wales Branch. "Plant Inspection as an Aid to Maintenance."

COVENTRY.—Technical College Room, 7.30 p.m. Institution of Engineering Inspection. "Jet Propulsion from the Pilot's Viewpoint," by Group-Capt. L. R. Stokes.

GLASGOW.—39, Elmbank Crescent, 7 p.m. I.E.E. South-West Scotland Sub-Centre. Chairman's address, by J. S. Hastie.

HAMMERSMITH.—Windsor Castle Hotel. 134, King Street, W.6, 7.30 p.m. A.S.E.E. West London Branch. "Catenary Cable Systems," by A. J. Betts.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. Chairman's address, by H. S. Moody.

LONDON.—At the Institution of Electrical Engineers, Savoy Place, W.C.2, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. Chairman's address, "Engineering and the Postal Service," by R. S. Phillips.

21, Bloomsbury Street, W.C.1, 2.30 p.m. Society of Relay Engineers. "Television Wire Broadcasting—P.O. Testing of Licensed Systems," by C. F. W. Hawkins and G. H. Barlow.

At the Royal Society of Arts, John Adam Street, Adelphi, 7 p.m. Incorporated Plant Engineers, London Branch. "Fire Protection in Factories and Works," by G. W. Underdown.

Storey's Gate, St. James's Park, S.W.1, 5.30 p.m. Institution of Mechanical Engineers, Automobile Division. Address by the chairman of the Division.

35, Grosvenor Place, S.W.1, 6.30 p.m. Electrical Association for Women, London Branch. Whist drive and social evening.

LOUGHBOROUGH.—Loughborough College, 6.30 p.m. I.E.E. East Midlands Centre. Chairman's address, by H. E. Knight.

MANCHESTER.—Engineers' Club, 17, Albert Square, 6.30 p.m. I.E.E. North-Western Centre. Chairman's address, by J. Prince.

NEWCASTLE-ON-TYNE.—At the Institute of Mining and Mechanical Engineers, Neville Street, 6.30 p.m. Institution of Heating and Ventilating Engineers, North East Coast Branch. Annual general meeting, "Heating and Hot Service for Moderate Rental Flats," by A. F. Myers.

NOTTINGHAM.—East Midland Electricity Board, Smithy Row, 7.30 p.m. A.S.E.E. Nottingham Branch. "The Permanent Way to Earth," by F. Porter.

RUGBY.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. Chairman's address, by W. S. Steel.

SHEFFIELD.—Grand Hotel, 7.30 p.m. Institution of Works Managers, Sheffield Branch. "Magnetism in Industry," by T. G. Hawker.

Wednesday, 8th October

ABERDEEN.—Caledonian Hotel, 8 p.m. I.E.E. North Scotland Sub-Centre. Chairman's address, "Amenity and Hydro-Electric Schemes," by L. B. Perkins. Preceded by informal dinner at 6 p.m.

BIRMINGHAM.—James Watt Institute, 6.45 p.m. I.E.E. South Midland Students' Section. Chairman's address, by B. H. Stonehouse.

BRADFORD.—The Midland Hotel, 7.30 p.m. A.S.E.E. Bradford Branch. "Electricity on Farms," by Mr. Hack.

FARNBOROUGH.—R.A.E. Technical College, 7.30 p.m. I.E.E. Southern Centre. "Technique in Illumination Engineering," by S. S. Beggs.

LEEDS.—Church Institute, Albion Place, 7.30 p.m. Institution of Engineering Inspection. "The Owen Organization," film show. Speaker, A. F. Rivers Fletcher.

LONDON.—I.E.E. London Students' Section, 2.30 p.m. Visit to J. Lyons & Co., Ltd., Cadby Hall, W.14.

At the London School of Hygiene and Tropical Medicine, Keppel Street, 6.30 p.m. British Institution of Radio Engineers, London Section. Annual general meeting, followed by Presidential address, by W. E. Miller.

At the Institution of Civil Engineers, Great George Street, S.W.1, 6.30 p.m. Institute of Welding. Presidential address, by A. R. Jenkins.

At the Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6 p.m. Royal Statistical Society, Study Section. "The Business Accountant and the Business Statistician," by S. Bray and P. Lyle.

NEWCASTLE-ON-TYNE.—Neville Hall, Westgate Road, 6 p.m. British Institution of Radio Engineers, North Eastern Section. "Germanium Crystal Valves, their Characteristics and Application," by B. R. Bettridge.

Crown Hotel, Clayton Street, 7 p.m. Purchasing Officers' Association, Tyneside Branch. Discussion on the National Conference at Harrogate.

NOTTINGHAM.—Welbeck Hotel, 7 p.m. Incorporated Plant Engineers, East Midlands Branch. "Protecting your Plant from Fire," by J. C. Elliott.

OXFORD.—S.E.B., 37, George Street, 7 p.m. I.E.E. Oxford District Meeting. "Short-Circuit Testing Technique," by J. G. P. Anderson.

PRESTON.—Harris Institute, Corporation Street, 7 p.m. I.E.E. North Lancashire Sub-Centre. Chairman's address, by H. Carpenter.

Thursday, 9th October

DUNDEE.—Royal Hotel, 7 p.m. I.E.E. North Scotland Sub-Centre. Chairman's address, "Amenity and Hydro-Electric Schemes," by L. B. Perkins.

KENTON.—"The Plough," Kenton Road, 12.30 p.m. Institution of Works Managers, Wembley Sub-Branch. "Factory Lighting."

LIVERPOOL.—Electricity Showroom, Whitechapel, 7 p.m. E.P.E.A. Merseyside Technical Group. "Atomic Energy," by J. C. C. Stewart.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Inaugural address as President, by Col. B. H. Leeson.

MANCHESTER.—Demonstration Theatre, N.W.E.B. Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. "Home Lighting," by Miss M. D. Wardlaw.

(*Continued at foot of page 759*)

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 12th November from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1946

25284. Martin, C.—Electric organ. 23rd August, 1946. (682501.)

36735. Sylvania Electric Products, Inc.—Glass envelope manufacturing machines. 12th December, 1946. (682502.)

1948

8265. Martin, C.—Electric organ. 19th March, 1948. Addition to 682501. (682503.)

26405. Akt.-Ges. Brown, Boveri & Cie.—Ejection or injection of electrons in magnetic induction accelerators. 11th October, 1948. (682504.)

30459. Dreyfus, J. A.—Electric relays and other electrical instruments. 23rd November, 1948. (682667.)

1949

2454. Compagnie Générale de Télégraphie sans Fil.—Travelling wave amplifier discharge tubes. 28th January, 1949. Cognate application 2455, 28th June, 1948. (682506.)

4197. British Thomson-Houston Co., Ltd., and Jefferson, H. F.—Electrical feeds for machine tools and log saws. 16th February, 1950. (682585.)

5619. Radio Corporation of America.—Electro-mechanical transducer. 1st March, 1949. (682586.)

8593. Toulon, P. M. G.—Apparatus for generating complex electrical waveforms. 30th March, 1949. (682672.)

10043. General Electric Co., Ltd., and Friedlander, E. S.—Alternating current electric motor arrangements. 13th July, 1950. (682588.)

12386. Jameson, J. L.—Method and apparatus for use in the production of turbine blades. 9th August, 1950. (682447.)

14127. British Thomson-Houston Co., Ltd.—Electric cooking ranges. 26th May, 1949. (682673.)

16952. Lucas, Ltd., J.—Electric lamps. 21st June, 1950. (682511.)

21179. General Electric Co., Ltd., and Martin, J. T.—Rising main busbar trunking electricity distribution systems. 15th August, 1950. (682513.)

23027. Philips Electrical, Ltd.—Arrangements for amplifying centimetre and decimetre waves, comprising a travelling wave tube. 6th September, 1949. (682515.)

24306. Metropolitan-Vickers Electrical Co., Ltd.—Thermal diffusion columns for separating components of mixtures of condensable vapours. 2nd August, 1950. (682392.)

24859. Stratton & Co., Ltd., Laughton, H. A. J., and Cox, H. N.—Setting mechanism of variable condensers and the like in radio and electrical apparatus. 27th December, 1950. (682681.)

25383. General Electric Co., Ltd., and Smith, R.—High-frequency electric induction heating apparatus. 3rd October, 1950. (682684.)

25876. Dryden & Sons, Ltd., T., and Barrs, J. W.—Electricity supply terminal connections. 2nd October, 1950. (682593.)

27137. Metropolitan-Vickers Electrical Co., Ltd.—Power plant. 29th September, 1950. (682396.)

30160. General Electric Co., Ltd., Cooper, M., and Dunham, C. R.—Apparatus for stabilizing the current in an electric load circuit. 24th November, 1950. (682688.)

30252. English Electric Co., Ltd.—Engine driven electric generating plant. 23rd February, 1951. (682594.)

30639/41. M.K. Electric, Ltd., Arnold, C. L., and Dowsett, R. W.—Electrical socket contact members. 6th November, 1950. (682595/7.)

30726. English Electric Co., Ltd.—Resilient devices. 24th November, 1950. (682598.)

31412. Hoover (Electric Motors), Ltd., and Plint, J. W.—Centrifugal electric switches. 6th December, 1950. (682599.)

31528. Philips Electrical, Ltd.—Methods of and means for re-magnetizing partly demagnetized permanent magnets in alternators. 8th December, 1949. (682600.)

32065. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Circuits for alternators having permanent field magnets. 14th December, 1949. (682601.)

1950

2868. General Electric Co., Ltd., and Page, B. H.—Electric heating elements and apparatus incorporating such elements. 26th January, 1951. (682697.)

4525. Westinghouse Electric International Co.—Inductive interference suppressors. 22nd February, 1950. (682610.)

4721. Metropolitan-Vickers Electrical Co., Ltd.—Apparatus for introducing specimens into an evacuated chamber. 1st December, 1950. (682530.)

4182 and 4867. Metropolitan-Vickers Electrical Co., Ltd.—Power plant. 23rd January, 1951. (682408 and 682410.)

5694. Concordia Electric Safety Lamp Co., Ltd.—Apparatus for topping-up electric batteries. 7th March, 1951. (682532.)

6638. Sangamo Weston, Ltd.—Electrical tachometers. 18th January, 1951. (682534.)

8170. Automotive Products Co., Ltd.—Electric switches and contact arrangements therefor. 12th March, 1951. (682538.)

9462/3. Westinghouse Electric International Co.—Control systems for electrically propelled vehicles. 18th April, 1950. (682615/6.)

9572. Herbert, Ltd., A.—Control systems for electrically driven milling and like machine tools. 4th July, 1951. (682617.)

10218. Claesson, P. H. E., and Johansson, K. L.—Electric measuring and indicating apparatus. 25th April, 1950. (682544.)

Next Week's Events—*continued*

NEWCASTLE-ON-TYNE.—Roadway House, Oxford Street, 7.30 p.m. Incorporated Plant Engineers, Newcastle-on-Tyne Branch. "Manufacture of Glass and Some Aspects of Toughened Glass," by D. Curran.

SPALDING.—Corn Exchange, 7.30 p.m. I.E.E. East Midland Centre. "Review of Overhead Lines," by N. G. Simpson.

Friday, 10th October

BRISTOL.—Institute of Welding, South Western Branch. "Design for Welding," by S. M. Reisser.

LONDON.—Townsend House, Greycoat Place, S.W.1, 7 p.m. Junior Institution of Engineers. "Electricity and Productivity," by H. J. Gibson.

NOTTINGHAM.—Victoria Station Hotel. Institution of Heating and Ventilating Engineers, East Midlands Branch. Ladies' evening.

Saturday, 11th October

LONDON.—I.E.E. London Students' Section, 10.30 a.m. Visit to the Royal Festival Hall, S.E.1.

12203. British Thomson-Houston Co., Ltd. Insulated electric leads. 16th May, 1950. (682711.)

14182. Wolseley Sheep Shearing Machine Co., Ltd., and MacNamara, H. J.—Insulators for electric wires. 6th June, 1951. Cognate application 28013, 16th November, 1950. (682715.)

14936. Allmanna Svenska Elektriska Aktiebolag.—Means for controlling the candle-power of luminous electric discharge tubes. 15th June, 1950. (682716.)

14972. British Thomson-Houston Co., Ltd.—Control systems for electric motors. 15th June, 1950. (682623.)

16800/1. Cinema-Television, Ltd.—Methods and apparatus for mounting and firing getters. 4th July, 1951. (682555/6.)

17242. Andreau, J. E.—Wind motors having hollow blades with a radial flow of air therethrough. 10th July, 1950. (682627.)

18979. Cole, Ltd., E. K., Parry, R. Y., and Finch, H. W. S.—Radio-active ore detectors. 27th July, 1951. (682557.)

19199. British Thomson-Houston Co., Ltd.—Excess voltage protective devices. 1st August, 1950. (682722.)

19891. Alkaline Batteries, Ltd.—Sealed electric cable connectors. 18th July, 1951. (682476.)

20432. Ohio Crankshaft Co.—High-frequency induction heating. 17th August, 1950. (682558.)

20661. Reyrolle & Co., Ltd., A., and Mordue, H.—Cleats. 20th August, 1951. (682633.)

21301. Crabtree & Co., Ltd., J. A., Morgan, R. W., and Coleman, E.—Shuttered electric sockets. 16th April, 1951. (682727.)

21362. Wimbledon Engineering Co., Ltd., Noad, J. E. G., and Armstrong, C. J.—Electromagnetic vibrators. 21st August, 1951. (682728.)

22637. Research Corporation.—System for energizing electrical precipitators. 14th September, 1950. (682733.)

23210. Philips Electrical Industries, Ltd.—Radio receiving circuit arrangements. 21st September, 1950. (682734.)

23519. Brooke, W., and Baldwin, H. T.—Electric protective systems for motors and other equipment. 26th September, 1950. (682425.)

24602. British Thomson-Houston Co., Ltd.—Coffee percolators. 9th October, 1950. (682640.)

27819. British Thomson-Houston Co., Ltd.—Shaft seals. 14th November, 1950. (682486.)

28065. Parsons, J. B.—Electromagnetic control valve device for fluid-pressure systems or the like. 16th November, 1950. (682644.)

29833. Westinghouse Electric International Co.—Automatic electric circuit breakers. 6th December, 1950. (682564.)

31513. Bendix Aviation Corporation.—Electrical time delay control device. 28th December, 1950. (682649.)

1951

821. Westinghouse Electric International Co.—Inductive interference prevention. 11th January, 1951. (682650.)

1927. Philips Electrical Industries, Ltd.—Electric incandescent lamps comprising a glass envelope, of which at least one part is made of moulded glass. 25th January, 1951. (682227.)

2326. British Thomson-Houston Co., Ltd.—Automatic hydraulic regulating systems. 30th January, 1951. (682049.)

2542. Standard Telephones & Cables, Ltd.—Modulators employing electromagnetic wave guides. 1st February, 1951. (682652.)

2563. Röder, K. A.—Turbines. 1st February, 1951. (682568.)

2886. Telefonbau und Normalzeit Ges.—Frequency expansion equipments for telecommunication systems. 6th February, 1951. (682569.)

4495. Welter, O.—Electrodes for acidic storage batteries. 23rd February, 1951. (682430.)

4467. Standard Telephones & Cables, Ltd. (Bell Telephone Manufacturing Co.).—Speed governor for telephone subset dial. 23rd February, 1951. (682368.)

4770. Radio Corporation of America.—Oscillator frequency control by resonant modulation of gas. 27th February, 1951. (682370.)

4862. Hoover, Ltd. (Hoover Co.).—Suction cleaners. 28th February, 1951. (682137.)

5118. Philips Electrical Industries, Ltd.—Multi-table circuit arrangements comprising a cathode-ray tube. 2nd March, 1951. (682297.)

5622. Westinghouse Electric International Co.—Regenerative control systems for dynamo-electric machines. 8th March, 1951. (682139.)

6645. Tomlins, F. C. (Western Electric Co., Inc.).—Electric cables. 20th March, 1951. (682433.)

7357. Amalgamated Wireless (Australasia), Ltd.—Volume control arrangements for radio receivers. 29th March, 1951. (682140.)

7856. Maschinenfabrik Oerlikon.—Combined steam turbine and gas turbine plants. 4th April, 1951. (682141.)

8182. British Thomson-Houston Co., Ltd.—Atomizing nozzles for liquid fuels. 9th April, 1951. (682576.)

9559. Krefft, H. E.—Lead-in seal for electrical discharge devices. 24th April, 1951. (682376.)

10494. Western Electric Co., Inc.—Metal to-glass seals. 4th May, 1951. (682377.)

11087. Czechoslovak Heavy Engineering Works and Grosse, V.—Air-blast switches. 4th May, 1948. (Divided out of 681985.) (682053.)

12008. Brooke, W., and Baldwin, H. T.—Remote control systems for electric motors. 23rd May, 1951. (682434.)

14405. Westinghouse Electric International Co.—Lightning arrestors. 18th June, 1951. (682380.)

14726. Steatit-Magnesia Akt.-Ges.—Electrical resistances. 21st June, 1951. (682655.)

15244. British Thomson-Houston Co., Ltd.—Electric lamps. 27th June, 1951. (682500.)

1952

15699. Brooke, W., and Baldwin, H. T.—Remote control systems for electric motors. 23rd May, 1951. Divided out of 682434. (682440.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 17th October :—

No. 704,229 (design), Class 9. Scientific instruments and apparatus, electrical instruments and apparatus included in Class 9, and wireless sets (complete).—Dasonda Singh, trading as Dasonda Singh & Sons, Mombasa, Kenya, British East Africa. Address for service, c/o King's Patent Agency, Ltd., 146a, Queen Victoria Street, London, E.C.4.

TRUCORD. No. B705,213, Class 9. Television and radio apparatus, and electrical apparatus included in Class 9.—R. D. Farrant, 34, Shepherd's Hill, Highgate, London, N.6.

NEOLITE. No. B708,537, Class 9. Luminous signs.—A. Webster & Sons (Burnley), Ltd., trading also as Webster's Neolite Signs, 77, St. James Street, Burnley, Lancs.

FURZEHILL. No. B708,911, Class 9. Electronic instruments for observing and recording electro-physical phenomena; and scientific instruments and apparatus for the control of industrial processes.—Furzehill Laboratories, Ltd., Shenley Road, Borehamwood, Herts.

EDISON. No. 661, 534, Class 11. Miners' electric safety lamps and parts thereof included in Class 11.—Thomas A. Edison, Inc., West Orange, New Jersey, U.S.A. Address for service, c/o Marks & Clerk, 57-58, Lincoln's Inn Fields, London, W.C.2.

ENDURA. No. 694,804, Class 11. Electric lamp bulbs for sale in specified counties.—Maurice End, Ltd., Endura House, 7, Blackfriars Street, Manchester, 3.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Ashford (Kent).—31st October. U.D.C. Street lighting. (See this issue.)

Formosa.—TAIPEI.—11th October. Central Trust of China. Power cable. (C.R.E. 30594/52. Ten/4768.)* 20th October. Electricity meters. (C.R.E. 32411/52. Ten/4801.)* 21st October. Induction motors and accessories. (C.R.E. 32482/52. Ten/4804.)* 23rd October. Transformers, oil circuit breakers and disconnecting switches. (C.R.E. 31709/52. Ten/4772.)* Relay current transformer and other electrical equipment. (C.R.E. 31974/52. Ten/4770.)* 25th October. Power plant for the Wu Lai station of Taiwan Power Company. (C.R.E. 32424/52. Ten/4811.)* 30th December. Power transformer, oil circuit breaker, disconnecting switches and insulators. (C.R.E. 31965/52. Ten/4771.)*

India.—TRIVANDRUM.—20th October. Secretary, Stores Purchase Committee, Government of Travancore-Cochin. Two 110 kV transmission lines with towers between Sengulam and Pallom, and Pallom and Kundara. (C.R.E. 31096/52. Ten/4759.)*

New Zealand.—AUCKLAND.—10th November. Auckland Electric Power Board. Cable and accessories. (C.R.E. 31975/52. Ten/4769.)* Pilot cable and accessories. (C.R.E. 32213/52. Ten/4785.)*

Northampton.—18th October. Corporation. Street lighting equipment. (See this issue.)

South Africa.—CAPE TOWN.—22nd October. City Electricity Department. Insulated copper conductors. (C.R.E. 32681/52. Ten/4799.)* PRETORIA.—30th October. Union Tender and Supplies Board. Electric battery chargers. (C.R.E. 31938/52. Ten/4757.)*

Torpoint.—23rd October. U.D.C. Electrical installations in twenty houses and flats. (See this issue.)

Uruguay. — MONTEVIDEO. — 22nd October. Usinas Electricas y Telefonos del Estado. Automatic circuit breakers. (C.R.E. 32278/52. Ten/4792.)* 28th October. Armoured cables and accessories. (C.R.E. 32364/52. Ten/4793.)*

Wakefield. — 31st October. Corporation. Street lighting equipment. (See this issue.)

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

ORDERS PLACED

Altrincham. — Corporation. Accepted. Street lighting, Stockport Road (£5,208).—Metrovick.

Edmonton.—Housing and Building Committee. Accepted. Installation of lifts in three 6-storey blocks of flats, Fore Street (£5,829).—Porn & Dunwoody (Lifts), Ltd.

London.—LEWISHAM.—Housing Committee. Recommended. Electrical work at Westwood Hill housing scheme (£2,954) and electrical installations at the Ermine Road and Embleton Road housing schemes (£995).—London Electricity Board. Supply of 238 3 kW electric immersion heaters for housing schemes.—Simplex Electric Co., Ltd.

Northern Ireland.—ANTRIM.—Carrickfergus Corporation. Electrical installation in 400 houses on the Victoria Road estate (£8,716).—Rotary Electric Co., Ltd.

TYRONE.—Cookstown U.D.C. Electric wiring of 54 houses (£1,162).—J. Henry.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bakewell.—Cottage flats (16), Haddon Road site, for U.D.C.; A. Lowcock, architect, Matlock Street, Bakewell.

Banbridge.—X-ray department, Banbridge and Dromore Hospital; T. T. Houston & Co., architects, 26, College Gardens, Belfast.

Bideford.—Medical and dental clinic; Devon county architect, 97, Heavitree Road, Exeter.

Billinge and Winstanley.—Houses (58), Birchley Road; W. C. Harris & Son, 5, Hardshaw Street, St. Helens.

Bosworth.—Houses (62), Manor Lane; R.D.C. architect, Bosworth, Leics.

Bristol.—Development of site for about 300 houses in the Great Western Street area; city architect, Colston Avenue, 1.

Burnley.—Transport garage, Stanley Street; borough engineer.

Bury.—Houses (160), Goshen estate; borough engineer.

Cardiff.—Additions, including X-ray department, at St. David's Hospital; secretary to Welsh Regional Hospital Board, Cathays Park, Cardiff.

Carlisle.—Additions at East Dale Street for H. Stevens & Son; Johnston & Wright, architects, Castle Street.

Chesham.—Flats (17), Victoria Road; L. C. Powell, architect, Norfolk House, Station Road.

Chiswick. — Flats (42), Hogarth Lane; W. F. J. Church, town clerk, Town Hall, W.4.

Churchdown. — Secondary modern school; Gloucestershire county architect, Shire Hall, Gloucester.

Consett.—Houses (36), Moorside, for U.D.C.; C.T.C., Ltd., builders, Queen Street, Blackhill.

Corby.—Factory; John White Footwear, Ltd., Higham Ferrers, Rushden.

Curdworth.—Factory; Charlesworth & Son, Ltd., 70, Birmingham Road, Water Orton, Castle Bromwich.

East Kilbride.—Factory; Hayward-Tyler & Co., Ltd., engineers, Edinburgh.

Enfield.—Houses and flats (138), Hoe Lane site; F. Lee, U.D.C. surveyor, 7, Little Park Gardens.

Evesham. — Houses (289), to be erected before 1954; borough surveyor, Municipal Offices, High Street.

Falkirk.—Houses (200), on site in Glasgow Road, Camelon; burgh surveyor, Burgh Buildings, Newmarket Street.

Gateshead.—Brewery additions for R. Rowell & Son, Ltd.; Cackett, Burns Dick & Mckellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

Gillingham (Kent). — Featherby Junior School, Chilham Road; F. Hill, town clerk, Municipal Buildings.

Church and classrooms, Goudhurst Road; C. W. W. Thompson, surveyor, Bank Chambers, High Street, Rochester.

Gloucester.—Flats (96), Matson estate; John Laing & Son, Ltd., Bunns Lane, N.W.7.

Hinckley.—Further 24 houses, Sketchley Hill and Mill Hill estates, and extension of Featherstone Drive to provide eventually for 150 houses; architect and surveyor, Hinckley, Leics.

Hornsey.—Six shops and 14 flats, Upper Tollington Park; borough engineer.

Huddersfield. — Operating theatre at St. Luke's Hospital; Joseph Berry & Sons, architects, 5, Market Walk.

King's Lynn.—Children's home; Norfolk county architect, 27, Thorpe Road, Norwich.

Liverpool.—Works of adaptation (£40,000) at Seamen's Orphanage; regional architect to Liverpool Regional Hospital Board, 88, Church Street.

Plans approved for 4,750 dwellings in central and older parts of city, including 10-storey blocks of flats; city architect, Blackburn Chambers, Dale Street.

London.—KENSINGTON.—Flats (99), on the Denbigh Road site; T. W. Sainsbury, town clerk, Town Hall, W.8.

LAMBETH.—School, Tulse Hill; Rush & Tompkins, Ltd., builders, 109, Station Road, Sidcup.

PECKHAM.—Nine flats, Reedham Street; Camberwell borough engineer.

Luton.—Additional classrooms at Stopsley and Challney Schools; borough engineer.

Macclesfield.—Stage 1 of new college of further education (1953-54 programme); county architect, Chester.

Manchester.—Factory, Wythenshawe; Farley's Infant Food, Ltd., Torr Lane, Plymouth.

Middlesbrough. — Rebuilding of stores, Linthorpe Road, for Dickson & Benson, Ltd. (£100,000); Hetherington & Wilson, architects, County Chambers, Westgate Road, Newcastle-on-Tyne.

Morpeth.—Houses (13) and flats (12); J. Dodds & Sons, Morpeth.

Newcastle-on-Tyne.—Engineering works, Mary's Place, Walker, for Henry Watson & Sons (Cylinders), Ltd.; R. W. Anderson & D. Foster, architects, 42, Pilgrim Street.

Medical centre, etc., Sandgate, for National Dock Labour Corporation; C. S. Errington, architect, 46, Grainger Street.

North Riding.—School at Eastfield; S. W. Milburn, architect, 9, Esplanade, Sunderland. School, Marske; J. H. Napper, architect, 56, Eldon Place, Newcastle-on-Tyne.

North Shields.—Erection of passenger terminal for Bergen Steamship Co. (£26,000); J. & W. Lowry, builders, Corporation Street, Newcastle-on-Tyne.

Norwich. — Reconstruction of business premises; Curl Bros. (Wholesale), Ltd., drapers, etc., Theatre Street.

Penrith.—Houses, Little Salkeld; J. A. Sedgwick, R.D.C. surveyor.

Sandbach.—Houses (46), on site off Crewe Road; H. J. Rees, U.D.C. surveyor, Council Offices, Crewe Road.

Scarborough. — Houses at Eastfield. Builders: Mollekin Brothers, West Parade Road, Scarborough (58), and E. Hunter, Ltd., Ceaconsfield Street, Scarborough (65).

Southport. — Works extensions (£78,000); A. Holland, Virginia Street Works.

Tiverton.—Houses (230), as first section of development scheme at Wilcombe Lane; borough surveyor, St. Andrew's Street.

Uttoxeter.—Houses (62), Copes Park Farm estate; U.D.C. surveyor.

Walsall.—Four-storey building as second section of Technical College scheme; M. E. Habershon, borough surveyor, Council House.

Weardale.—Houses (110) at the Causeway, Wolsingham; J. Lawton, R.D.C. architect, Stanhope.

West Bromwich.—Machine shop, Hollow Bank; Wm. Kendrick & Sons, Ltd., Tasker Street, Walsall.

Secondary school at Churchfields; H. Schofield, borough surveyor, Town Hall.

Whickham.—Houses (94); G. S. W. Urban Development Co. Dunston-on-Tyne.

Wiltshire.—Fire station, Corsham; county architect, County Hall, Trowbridge.

Worthing.—Refuse disposal plant and buildings, Meadow Road; borough engineer.

Yiewsley.—Works extensions; Anglo-Swiss Screw Co., Ltd., Trout Road.